FOOD MANUFACTURING

A Compendium of Food Information, with Practical Factory-Tested Commercial Formulae

FOR THE

FOOD MANUFACTURER, CHEMIST, TECHNOLOGIST,

IN THE

CANNING, FLAVORING, BEVERAGE, CONFECTIONERY, ESSENCE, CONDIMENT, DAIRY PRODUCTS, MEAT AND FISH, AND ALLIED INDUSTRIES

by

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PREFACE

Because of the constant call for new methods and means for meeting the ever increasing demands for new and more desirable manufactured products, I have herein endeavored to disclose the results of my experience in the manufacture of foods, as well as an investigation of methods developed and used by other specialists in this field.

In many instances I have mentioned certain trade-named ingredients but I wish it understood that the purpose of this book is to supply the manufacturer with valuable information regardless of the source of supply of raw materials.

Many thanks are due to my associates in the food manufacturing industry for their willing cooperation, and to the friends who have aided with their constructive criticism.

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CHAPTER I

METHODS AND EQUIPMENT

Food manufacturers who wish to be successful must plan wisely and manufacture their products scientifically and with understanding. Food technology, the science of manufacturing foods, is governed and regulated by well defined chemical, bacteriological and physical principles. These principles must be followed carefully or much grief and spoiled merchandise will result. Due to the lack of space only a few of the more important methods of food manufacturing will be described here. However, there is much information available today along these lines and it is incumbent upon each food manufacturer to make use of this knowledge before working on a new product or entering a new food field.

HEATING—PASTEURIZATION—STERILIZATION

Heating is a common process of food manufacture. With the aid of heat, moisture is extracted, solution is effected, ingredients softened, etc. Heat may be generated in five ways:

1. Solid fuels, e.g., wood, charcoal, coal, or coke.
2. Liquid fuels, e.g., alcohol, gasoline, or kerosene.
3. Combustible gases.
4. Electricity.
5. Process steam.

For measuring heat the two most common scales in the U. S. are the Centigrade and Fahrenheit thermometer scales. To convert Centigrade to Fahrenheit, the Centigrade reading is multiplied by 1.8, followed by the addition of 32 to the product. To convert Fahrenheit to Centigrade, 32 is subtracted from the Fahrenheit reading and the remainder is divided by 1.8.

Pasteurization and sterilization are synonymous to a great many people. This idea is partly sound because both terms refer to methods for the destruction of bacteria. The difference between the two methods is that pasteurization does not kill all bacteria, whereas sterilization does; milk is a good example of that difference. If the pasteurization temperature is sufficiently high and maintained for a long enough period, and only the

harmful bacteria have been destroyed, the product may be said to have been pasteurized; on the other hand, a product in which all living forms of bacteria have been destroyed is known as sterilized. The sterilization temperature varies considerably and depends upon the food and existing knowledge about the temperatures to be employed. For example, those fruit juices having a high percentage of acidity may be pasteurized at lower temperatures than those with lower acidity; e.g., prune juice requires a much higher temperature for pasteurization (due to its lower acid content) than grape juice. Some foods, such as vegetables (excepting those that are high in acid content), require sterilization temperatures above 212° F to insure complete destruction of all bacteria. To obtain the high temperatures, a retort or autoclave is used in the media, which is either live steam or water heated by means of steam; this method is known as pressure sterilization.

The temperature of steam at various pressures is as follows:

Pounds per square inch pressure	*Temperature of steam*
14.7 (atmospheric)	212° F.
17	219.6
25	240.1
35	259.3
50	281.0
75	307.4
100	327.9

Vaporization:

Vaporization is a process employed to separate volatile substances from a mixture. When vaporization is employed to separate a volatile liquid from one less volatile, it is called distillation. The removal of a volatile liquid from a solid is known as dessication or dehydration. The separation of a volatile solid from another solid is known as sublimation. The rate of vaporization by boiling, assuming that the temperature and pressure are equal, will depend upon the surface area of the boiling liquid exposed. If the liquid contains soluble solids, it will offer more resistance to evaporation; e.g., a starch solution. The depth of the liquid will also be a controlling factor for the rate of evaporation, as against shallow pans which allow a faster rate of evaporation.

Vacuum Boiling:

In this process the boiling point of the liquid is lower than in ordinary vaporization. This is accomplished by lowering the pressure on the inside

of the equipment. Liquids that are manufactured in a vacuum boiling outfit are less subject to injury, loss of color and flavor and, in the case of solids like strawberry jam, the distortion of the shape of the fruit.

Distillation:

The process of removing volatile from less volatile substances is really the same as evaporation, except that the vapors are conducted through a closed condenser system and recovered. By means of a cooling liquid these vapors are converted to the liquid or solid state. In this manner essential oils, like peppermint and cloves, can be recovered from the leaf and bud.

Sublimation:

Sublimation is the process by which volatile solids are obtained from a mixture containing admixed and fixed impurities. The sublimation of crude iodine, wherein the last traces of impurities remain behind in solid form, is a good example of this process.

Dessication or Dehydration:

This is a process by means of which substances are deprived of their moisture content. By this method, a bulky material can be reduced to a small dry quantity and the product kept for a long period of time. The drying process is accomplished in any of the following ways:

(a) Drying in the sun
(b) Special heated room compartments
(c) Spray drying
(d) Vacuum pan drying
(e) Steam heated drum roller drying

Leaching or Extracting:

Leaching is the process of removing, with the aid of water or other liquids, the soluble components of a mixture. These components may be sugars, minerals, dextrin, flavoring material, etc. The amount of liquid obtained as the result of the leaching process may be calculated on the basis of one fluid ounce as equivalent to one solid ounce of the original mixture, etc.

Solution:

A solution is a homogeneous mixture of two or more components, one (usually liquid) called the solvent and the other, the solute. If the amount of solute exceeds that which can normally be dissolved by the

solvent, it is called a super-saturated solution. The excess amount added will precipitate out, upon addition of a crystal of solute. A substance that will not dissolve in water or another solvent is insoluble in that solvent.

Simple Solution:

When a solute is added to a solvent and no alteration in chemical properties takes place, the system is known as a simple solution. If the solvent, in turn, were completely evaporated, the original solvent would be recovered.

Chemical Solution:

When a solute is dissolved in a solvent and its properties are changed, a chemical reaction or a physical addition has taken place in the solution. If this solution is evaporated down to dryness, a compound different from the original solute will be recovered. Pulverization, agitation and heating are aids in bringing about rapid solution. The solvents that are commonly used in preparing solutions are water, alcohol, glycerine, ether, chloroform, benzene, acetone, acids, oils, etc.

Separation of Fluids from Solids:

This may be accomplished by means of decantation, siphoning, straining, or filtration.

Clarification and Decolorization:

Clarification is a process by means of which insoluble or colloidal ingredients are removed from the liquid. Clarification may be accomplished with or without the use of a filter or strainer. It is the solid substance in a liquid which, if not removed, interferes with the transparency of the liquid. The clarification of ingredients can be accelerated by:

a) Heat.
b) Increasing fluidity with the addition of water, alcohol or oil.
c) Coagulation with the aid of albumen, gelatin, bentonite.
d) Fermentation.
e) Long standing.

Liquids may be decolorized with the assistance of Fuller's earth or decolorizing carbon, etc. The process known as extraction, expression, or percolation, is the method employed to remove the soluble constituents from a mixture.

Centrifuging:

This is a process of separating a solid or liquid, which depends upon the force developed by the spinning of a centrifuge. This piece of equipment usually operates at a speed of several thousand revolutions per minute.

SIFTING

This is a method employed in the separation of fine and coarse particles. The sieves are made up with different meshes (openings per square inch) and may be operated by means of hand or machine shaking.

FOODS

Preliminary Preparations:

Fruits and vegetables, such as apples, tomatoes, apricots, oranges, cherries and plums, when picked may be covered with accumulations of insecticide sprays and dirt. They must, therefore, go through a cleansing, scouring or softening-up process. This process may consist of washing, blanching, peeling, coring, bleaching, grading and picking out the bruised fruits from the sound ones. Fruits and vegetables can be washed or soaked in hot or cold water, with or without agitation, in large tanks or troughs. The wash water may be agitated by means of a propeller, recirculation pump, or washing down by means of fine sprays above and below; the vegetables and fruits move on conveyor belts.

The scalding and bleaching of fruits and vegetables cleans and preheats them, prior to processing or canning. This step is important because, by removal of the adhering dirt, the chances of introducing disagreeable odors and flavors in the finished product are reduced to a minimum. Many fruits and vegetables have to be peeled first, and this may be accomplished by hand, mechanical, or lye peeling machinery. Where lye peeling machinery is used, the peel is disintegrated and the fruit or vegetable led into a rotary washing machine, where it is sprayed and washed down by water. This results in the removal, or brushing off, of the peel and the washing off of the lye. Some vegetables or fruits have to be cut in half, placed on trays and peeled by exposure to live steam. Fruits and vegetables sometimes have to be graded to obtain uniformity and size before processing or canning. For example, cherries, plums and olives are graded for size, while peaches, apricots, pears are halved first before grading. The types and styles of graders used are numerous. Some are of the vibrating type, with circular openings of various diameters on the screens, while the cherry grader is a rotary cylinder; the small

sized fruits are first removed, then the next larger ones, and so on, depending on the manner in which the cylinder is constructed.

In the processing of canned fruits and vegetables, the importance of adequate and proper processing and temperature sterilization of the product cannot be over-emphasized. Canned goods when made properly will withstand spoilage by bacteria and fermentation. The use of moldy, soft, or rotten ingredients is highly objectionable and must not be tolerated in any food plant. In the manufacture of jellies, jams, preserves, and marmalades, employing large amounts of sugar and syrups, the factory should always be kept under strict sanitary control. Carelessness and filth will result in the growth of pests and insects which, in turn, if not under control, will manage to get into the finished products. The equipment required in the manufacture of foods, especially when steam jacketed equipment is handled, should be placed far apart, and should be constructed so that the operator can extract the products with ease. There should be enough drains, close to the equipment and in several parts of the plant, so that flushing down with water is a simple procedure.

Food Plant Equipment:

The equipment problem of the food products manufacturer and canner is a many sided one. It generally involves such destructive factors as corrosion, abrasion, and hard, rough usage, plus the imperative need for immaculate cleanliness and hygienic conditions at all times.

The importance of strict sanitary conditions in the food plant cannot be over-emphasized. There is always present the menace of possible contamination of the product to destroy profit margins and to cause permanent injury to plant reputation and investment. Further complications are brought in by stringent regulations of federal, state, and local health authorities.

All these facts dictate the need for careful design, satisfactory construction and suitable materials to provide, in addition to strength, durability and smooth performance, the necessary cleanliness, attractive appearance, and freedom from contaminating influences. Wood and other absorbent materials obviously cannot be used for most purposes. The limitations of tinned, galvanized, plated and similarly coated materials are apparent. For many items of equipment only a solid metal will do.

The acceptance of Monel metal, nickel, stainless steel, aluminum, etc. by manufacturers and users has grown steadily for parts of food plant equipment coming into contact with the product. They are solid, rust-proof metals and should not be confused with plated or coated materials. These metals are generally more resistant to corrosion. They remain practically unaffected by a wide range of materials. They have a smooth,

hard surface that is easily cleaned. They resist wear and abrasion and are durable in the hardest kind of service.

De-aerators:

Food chemists have long known that fruit and vegetable juices, fruits, catsup and many other heavy products deteriorate in color, flavor and aroma on exposure to air and light. Fruits, vegetables, and their various juices, whether in bottles or cans, contain varying amounts of air, the amount depending entirely upon the method of manufacture. For example, citrus juice contains large amounts of air because of the air in the intercellular spaces of the fruit, and also because of the unavoidable contact with air during the extracting and finishing process. The air contained in the finished product may be either in the form of dissolved or occluded air. Bubbles, apparent to the eye, in viscous products, such as mayonnaise or catsup, are an example of occluded air. The loss of life and pep in carbonated beverages upon opening is largely due, either to solid particles in colloidal suspension, or air in solution. The solid particles and air in solution act as nuclei about which bubbles of carbon dioxide can form and escape. Air bubbles rising to the surface in a freshly opened bottle will carry out seven times the volume in carbon dioxide.

De-aeration of the ingredients would bring about a relatively more stable condition in a saturated carbon dioxide atmosphere. The presence of air in fruit juices results in the development of an oxidized flavor. To manufacture an improved product, as free as possible from this detrimental air and oxygen, de-aerating equipment is used. This equipment consists of a unit into which the liquid is sucked in by means of a vacuum. In this process the liquid may be finely sprayed inside of this vacuum chamber, thus breaking up the dissolved or occluded air. The advantages of using de-aerating equipment are:

a) Almost complete removal of both dissolved and occluded gases.
b) Elimination of air bubbles, which in turn prevents excessive foaming.
c) Production of a finished product that retains the maximum amount of freshness and flavor over a very long period of time.

Dice and Cube Cutters:

These machines are furnished with cutting dies for making 3/8 inch cubes of orange, grapefruit, lemon, etc., peel. (The size may run as high as 7/8 inch cube.) Usually the material is fed to the hopper, where it is cut into horizontal slices, and then passes through the cubing dicer in

the center of the machine, at which point the cut cube is forced down by means of a vertical plunger.

Filters:

The operation of a pressure leaf-filter is quite simple and requires no special skill. Filtering material is added to the unfiltered liquid in the mixing tank, and this mixture re-circulated through the pump, flowing out of the mixing tank and back into the same tank again, causing the filtering material to be thoroughly dispersed in the liquid. The mixture is then re-circulated through the filter tank, where the material is gradually deposited on the screens of the frames to form a precoat. The circulation continues until the filter bed is set and the affluent filtrate runs clear. After this step, which takes only two to five minutes, the actual filtration starts.

The filtering media are:

a) Asbestos filtering material alone.
b) Diatomaceous earth mixed with asbestos filtering material.
c) Diatomaceous earth alone.
d) Carbon and diatomaceous earth.

With any of the above media, diatomaceous earth can be added in proper proportion during the run to keep the filter layer open.

The asbestos filtering material has an immediate filtering and absorptive action and a very sharp filtering effect on microscopic particles of turbid matter. A crystal-clear filtrate is assured without any long, costly preliminary run.

Principle of Operation:

The filtering unit in a sheet filter press consists of two frames with an asbestos filter sheet between them. One frame feeds the turbid liquid, and the other frame discharges the clear liquid. Multiples of these units can be added to gain the desired capacity; the operation is extremely simple.

Clarification:

Filter sheets are available in a wide range of porosity to suit the requirements of various liquids and maintain the desired relationship between clarity and output.

Sterilization:

With the sterilization sheets, guaranteed 100% germproof, it is possible to remove from liquids all bacteria and micro-organisms by cold

filtration. Moreover, the filter is so constructed that it can be steamed without damaging any of the parts, thus assuring complete sterilization.

Combined Runs:

A special bi-pass plate permits double filtration in one run. The filter is divided into two sections: one is set with porous sheets, and the other with a finer grade sheet for clarifying or sterilizing.

Removing Residue:

For filtering large amounts of powder, like charcoal, the screened frames may be replaced with open inlet frames to collect the residue. They are supplied to form cakes up to 1½ inches thick.

Filter Sheets:

While clarifying and germproofing sheets are noted for their high standard of efficiency, other types of filter media can also be used in sheet filters, such as filter cloth, filter paper, fine wire mesh, and other combinations.

Diversified Industries:

The liquids that can be filtered through sheet filters are practically unlimited. They include wines, cider, vinegar, beer, water, cordials, whiskey, fruit juices, vegetable juices, medicines, tonics, lotions, perfumes, chemical liquids and many others.

High Yields:

Flow-rates depend on the liquid, temperature, pressure (either gravity or pump), number of frames used and grade of filter sheet.

Fruit and Berry Washer:

The fruit is dumped into a hopper and, after being conveyed on a special carrier belt with the water in a pulsating motion, is finally discharged, free from dirt, mold and other matter, ready for canning or preserving.

Juice Extractor and Pulper:

This type of machine merely squeezes the juice out of fruits and vegetables. It is so constructed as to extract the maximum amount of juices with a minimum crushing of seeds and other tissues. In this type of machine the fruit is fed into a hopper on the top. A screw conveyor conducts the fruit to the press. This is usually of a conical screw, revolving in a perforated screen housing, with a screw on the bottom. As the

fruit is pushed forward and the pressure increased, the clearance between the screw and the housing diminishes, and in this way the juice is gradually squeezed out. The pulp comes out at the end of the press. The resulting juice made this way is usually very pulpy and cloudy. However, if the pressure is light, the juice is clearer but the yield is low.

Pickle Slicer:

This machine consists of a series of containers slotted and grooved to permit pickles to pass at right angles through stationary knives. The metal on the slicer is usually heavy, malleable and tinned by the dipping process, or fabricated from bronze, nickel alloy or pure nickel. For cucumbers or pickles, there may be as many as 40 slots or containers in which the pickles are cut through by knives.

Spray Dryers:

Spray drying machines are now commercially used for the manufacture of milk and egg powders and many other combinations of raw materials. Spray drying will reduce a substance to powder by evaporating moisture from the atomized particles. The evaporation is accomplished by enveloping the particle with an artificial vacuum, resulting from the low vapor pressure of a hot drying gas. (The same evaporation would occur if an actual vacuum were maintained outside the particle, since it does not depend entirely on direct contact with the hot gas.) This is a cooling process because the energy of evaporation comes largely from the particle. While evaporating moisture, the temperature of the particle can never exceed the wet bulb temperature of the hot air surrounding it. With delicate products this factor is highly important. The envelope of expanding vapor, constantly surrounding the particle, cools the molecules of hot air before they reach the particle itself. As a result, in spray drying, all particles are at a far lower temperature than the surrounding atmosphere and can thus withstand a temperature that would under ordinary circumstances destroy them.

The atomization of the liquid is a vital factor in the successful operation of a spray drying chamber. The spray produced must be uniformly fine, so that its inertia upon leaving the atomizer will not carry it through surrounding hot air currents to the nearest solid object. If a few of the particles produced are relatively large, in time the interior of the chamber will become coated with damp material and cause a shut-down. The fluid must be so evenly distributed that a uniformly fine mist will float in the air currents, like a fog. On leaving the atomizer, the thin sheet of material is broken-up by the combination of surface tension and the impact of the air, at the periphery of the wheel.

The production capacities of spray drying chambers depend on the substance dried. Variation is caused by differences in the concentration of the substances or the varying vapor pressure characteristics that result from changes in concentration during drying. The melting point of some solids also has a vital bearing on productive capacity.

The many advantages derived from spray drying are as follows:

1. It concentrates, dries and powders fluid or semi-fluid substances, without appreciable loss of vitamins and enzymes, or such qualities as flavor, aroma and color.
2. The physical characteristics of the product are usually effected, solubility is increased, particle size is controlled and the product is rendered free-flowing.
3. It is effective on thick pastes or heavy creams, as well as highly fluid materials.
4. The process is continuous and can be rendered semi-automatic so that labor is at a minimum.

Steam Jacketed Kettles:

This equipment is built for either low or high pressure steam work. The kettles are usually made of a one piece outside bowl construction, which is kept together by means of rivets. All kettles before use should be tested as to whether they are able to stand the hydrostatic pressure for which they are guaranteed. A high pressure steam jacket kettle can be used for all manufacturing purposes, whereas this is not true of low steam pressure kettles. Where solid materials are made in the kettle, a gate valve should be used; for liquids, the ordinary faucet attached to the kettle will be satisfactory.

Rack and Cloth Hydraulic Press:

In this type of press the crushed fruit, which may be previously heated in the presence of hot water, is allowed to run on heavy coarse weave press cloths between racks made of wooden slats. When a number of racks have been built one on top of another, pressure is applied by means of a hydraulic pump. A pressure of at least 500 pounds per square inch is necessary for the best results. The press cakes or pomace are then removed and may be dried for animal food purposes.

Reaming or Burring Machine:

This machine is commonly used to express the juice of oranges, lemons, etc. The whole fruit is cut in half and the juice extracted by pressing the halved fruit against a revolving conical ribbed or grooved extractor. The juice is then strained to remove coarse particles and seeds.

Retorts:

Retorts are important pieces of equipment for processing and sterilizing food products. Peas, beans, corn and all non-acid products, requiring a temperature higher than boiling point, must be processed in retorts. All retorts come furnished with temperature and pressure instruments.

Pasteurizers:

Flash pasteurization calls for tubes made of special metal, through which the product is conducted. The outer jacket of the tube may be heated by means of steam or hot water. The time required for the passage of the juice through the coil is carefully regulated. The coils may also be submerged in hot water.

Large wooden or metal tanks, with steam coils on the bottom and a perforated false bottom, are also used as pasteurizers. The filled cans or bottles are arranged in baskets, submerged in the water which is gradually brought up to the right temperature.

Continuous pasteurizers are used, in which the bottles of juice are carried by a basket along a moving conveyor belt passing through increasing temperature zones and then through decreasing cooling temperature zones.

Filling Machines:

These machines are now available for vacuum, gravity and siphoning filling. The siphon filling machine allows a predetermined amount of the juice to rise in the well. Coming out of the well are six or seven spouts, through which the liquid flows directly into the bottle and stops at a predetermined height.

Rotary Blancher:

This blancher is so constructed and controlled that the material is blanched in a definite time. The rotary drum is usually made of solid galvanized steel. It contains a spiral which conveys both the blanching water and the product through the blancher to a rotary drain screen which is part of the drum. Blanching water is automatically kept at the desired level by means of a float valve, and is heated by means of a perforated coil.

Straining and Clarification:

Operations of filtration, clarification or straining enter into the manufacture and processing of a very wide variety of food products. The materials for the construction of such equipment must be highly resistant to corrosion and must in no way contaminate the product.

The most commonly used equipment is probably the simple gravity filter using a corrosion proof metal container with false bottom, metal filter cloth, and backing wire or perforated plate.

Filter cloth and winding wire are employed in many types of rotary and continuous filters and, frequently, the entire filter drum and tank are made of metal. Filter cloth is also adapted to filter presses and may be obtained gasketed for this purpose. Both corrosion proof metal and filter cloth may be obtained from regular wire cloth manufacturers.

Centrifugal extractors with metal baskets, wire cloth liners, etc., are widely used as are the high speed centrifuges, employed principally for the clarification of fruit juices, syrups, and the like.

More recently filters using the system of edge filtration and employing a series of thin metal discs have come into use.

Vapor Vacuum-Seal Closing Machine:

This is a machine in which a bottle cap is vacuum-sealed in the presence of a hot injection of high pressure steam. The surface of the liquid or solid is rendered sterile by this high temperature steam.

Tomato Washer:

This type of machine washes tomatoes for all purposes, juice, canning, pulp and katchup, and cleans the tomatoes without bruising or breaking them. The fruit falls into water from the hopper, is fed through and under the water in the soaking tank by a large spiral, and sprayed with clean water as it is raised from the tank to the trimming table.

The action of the spiral keeps the tomatoes rubbing and rolling over each other, always in and under the water. They do not touch rough or sharp edges during their travel and are not raised out of the water and dropped back. In operation the tank is filled with water for more than one-third the height of the spiral, which prevents the tomatoes from carrying up on the side and dropping back, and keeps them floating all the time.

Vegetable Peeler:

The most important types of vegetable peelers are the mechanical machine peeling or lye peeling varieties. The lye peeling machine consists of an enclosed conveyor on which the fruit to be peeled travels in a submerged position. Usually the lye solution is made by dissolving approximately ½% to 2% of lye; the temperature at which peeling takes place is around 212° F.

The inside of a mechanical vegetable peeler consists of an abrasive material, like carborundum, fused directly with the metal. The walls

are composed of many particles of flint compound together with a specially prepared cement mixture. These walls average two inches in thickness and present a permanent abrasive surface. In front of this machine is a discharge door which catches any water seeping out and returns it to the peeling chamber. The vegetables to be peeled are fed in through the top of the machine, wetted down by streams of water, and, due to the centrifugal force, peeled by constant rubbing of the vegetables against the abrasive material.

Vegetable and Fruit Washer:

This machine is designed to wash tomatoes and deliver them to the scalder. It is arranged with three revolving shafts and paddles which constantly stir the tomatoes while they are in the water, causing them to rub against each other, and cleaning them more efficiently than any other known method. It even removes mold from the cracks. The machine is provided at the feed end with an intake water pipe, at the back with an overflow, and at the bottom with a large sand gate. As the tomatoes are carried up on the slatted chain, they are subjected to a thorough spraying from two perforated pipes.

CHAPTER II

BASIC FOOD INGREDIENTS, THEIR PROPERTIES AND USES

ALCOHOL, ETHYL OR GRAIN ALCOHOL

Among the raw materials used in the food industries, ethyl alcohol stands out as one of the most important. (It is also known as grain alcohol and cologne spirits.) Ethyl alcohol is obtained by the fermentation of sugar solutions and saccharified mashes of starch-containing materials. There is also a substantial quantity produced synthetically.

The sugar content of molasses (a cheap source) lends itself to being converted into alcohol. It accounts for almost 75% of the alcohol produced. Blackstrap molasses containing between 50% and 60% of sugar by weight, a by-product of cane sugar mill operations, is principally used. The sugar in blackstrap molasses is present as sucrose, $C_{12}H_{22}O_{11}$, and glucose or grape sugar (invert sugar), $C_6H_{12}O_6$.

Alcohol is produced from molasses by a fermentation process in which the sugars are converted to alcohol by the action of enzymes. The molasses is made into a mash, so that the final concentration of sugar falls within a range 15% to 25% by weight. Cultured yeast is then added in quantities ranging from 3% to 10% by volume and a vigorous fermentation ensues.

The yeast has a double action upon the sugar. This is brought about by the presence of two enzymes in the yeast, invertase and zymase. Invertase converts the sucrose into sugars of the invert type.

$$\underset{\text{(Sucrose)}}{C_{12}H_{22}O_{11}} + \underset{\text{(Water)}}{H_2O} \xrightarrow{\text{(Invertase)}} \underset{\text{(Invert sugar)}}{2\ O_6H_{12}O_6}$$

The zymase then converts the invert sugars into ethyl alcohol and carbon dioxide.

$$\underset{\text{(Inverted Sugar)}}{C_6H_{12}O_6} \xrightarrow{\text{(Zymase)}} \underset{\text{(Ethyl Alcohol)}}{2\ C_2H_5OH} + \underset{\text{(Carbon Dioxide)}}{2\ CO_2}$$

Temperature and nutrients added to the mash are carefully controlled to sustain the vigorous activity of the yeast. The yeast itself does not undergo any change during the 36 to 48 hours that it takes to yield the maximum amount of alcohol but merely acts as the agent for converting sugar to alcohol. The resulting alcohol content due to fermentation may

be from 6% to 12%. The mash is then redistilled twice, thus removing the aldehydes, esters and fusel oils, which impart a distinct undesirable odor to alcohol. Among the byproducts recovered from the purification of the alcohol are carbon dioxide, potash for fertilizer, vitamin concentrates for feedstuffs, and binders for the foundry and coal processing industries.

Starch in the form of grain when cooked with water, and then treated with barley malt, is converted by the diastatic enzymes into sugar. The addition of yeast will then ferment this sugar into alcohol. A method developed, known as the Amyl Process, saccharifies and then ferments starches into sugars and alcohol during the same process. This process had its origin in a study made by Dr. Calmette of the so-called "Chinese Yeasts." The molds are able to saccharify starch rapidly and the combination of yeasts and mold thus carries out the two steps, converting the starch to sugar and the sugar to ethyl alcohol, in the mash. Very little alcohol, however, is made in this country by this method. Synthetic ethyl alcohol is also produced by a number of methods.

ALCOHOL:

Ethyl Alcohol	C_2H_5OH. Molecular Weight 46
Also known as	Grain Alcohol
	Fermentation Alcohol
	Cologne Spirits
	Spirits of Wine
Color	Colorless
Odor	Ethereal, vinous odor
Taste	Pungent
Properties	Limpid, volatile liquid
Specific Gravity	0.7851
Boiling Point	78.4° C.
Solubility	Soluble in Water, Ether, etc.
Grades	Absolute Alcohol 99.80% Alcohol
	Rectified Spirit 95% Alcohol or more
	Cologne Spirit
	Pure Distillate 95%-96% Alcohol

ALDEHYDES:

These compounds represent a class of pungent aromatic fruity liquids, utilized to reinforce flavor, especially in such foods as strawberry, raspberry, cherry, pineapple, orange, lemon, lime and many other fruit products. The aldehydes are expensive and being very powerful must be used with care.

AMYL ALCOHOL:

This is a colorless oily liquid having a penetrating characteristic odor. One part is soluble in 40 parts water and it is miscible with alcohol, ether and chloroform. It is recovered in the purification of ethyl alcohol, and is extensively used for flavoring whisky, liquors, fruit essences.

VANILLIN:

Vanillin is obtained as the methyl and ethyl derivatives; ethyl vanillin being the stronger of the two in flavor. They are both crystalline and excellent for flavoring liquids and foods. They should be used sparingly since the flavor becomes more pronounced upon standing.

COUMARIN:

Coumarin occurs as colorless aromatic crystals. It is used for flavoring liquids and foods, and to reinforce the vanillin flavor in products. Generally coumarin may be substituted up to one third of the total vanillin content.

GLYCERIN: (Glycerol)

Glycerin is a liquid obtained by the hydrolysis of vegetable or animal fats or fixed oils, then purified by distillation. If olive oil (principally glyceryl oleate) is saponified with alkali (sodium hydroxide), sodium oleate (soap) and glycerin are the resulting products. Glycerin is, therefore, derived primarily from the glycerides (like glyceryl oleate) present in, and essential to, every kind of life. Glycerin is also produced through the fermentation of sugars, wines, beer, bread and other fermented products.

Pure glycerin is a colorless, odorless, sweet tasting, viscous, high boiling, substantially non-volatile liquid, containing not less than 95% of glycerin. It finds wide employment in the preparation of base extracts for flavoring purposes, in food color concentrates, in the extraction of drugs and in many other procedures. Glycerin is soluble in all proportions in water and alcohol and is insoluble in most organic solvents.

Because of its efficiency as a moistening agent, glycerin is very useful to the baker and confectioner. It retards the drying out of cakes and icings and the products remain fresher. It has been recommended for the prevention of mold growth in bakery goods, and replaces part of the egg in cake recipes, making the product lighter. Modern production of candy utilizes glycerin both as a sweetening and preservative ingredient. Many delicatessen formulas for pickles, fish and meat products, also use glycerin. In another section there will be found advance information on the application of glycerin in many important branches of the food industry.

TRIACETIN:

Glycerin forms esters with acetic acid, known respectively as mono-, di-, and triacetin, which are used technically as solvents.

Triacetin is a white, colorless liquid, having a boiling point of 275-280 degrees C. It is free from odor, non-toxic, and a very good solvent for oils, ethers and esters. It hydrolyzes (decomposes) in the presence of water and thus should not be used with the latter.

PROPYLENE GLYCOL:

This is a viscous, hygroscopic liquid that is a better solvent than glycerin. Its use in food products has recently been permitted in the United States.

AMYL AND ETHYL ESTERS, ETHERS, ALCOHOLS AND ALDEHYDES

These are all aromatic flavoring chemicals, manufactured or extracted, and are used to augment certain flavors.

The acids used in combination with flavoring substances are formic, acetic, butyric, propionic, lactic and others.

The esters result from the action of organic acids on alcohols. They differ, in odor, boiling points, and a number of carbon atoms. A pure ester is always free from water and alcohol. It is also requisite that a sample should be clear and free from turbidity when dissolved in benzene and, in some cases, in a liquid paraffin.

AMYL AND ETHYL ESTERS AND ETHERS

Amyl acetate	Imparts fruity, ethereal flavor.
Amyl benzoate	Imparts cherry, plum, prune flavor.
Amyl butyrate	Imparts fruity ethereal flavor.
Amyl formate	Imparts apricot, peach flavor.
Amyl isobutyrate	Imparts fruity ethereal flavor.
Amyl propionate	Imparts apple, pineapple, strawberry flavor.
Amyl valerate	Imparts peach, pineapple flavor.
Butyl butyrate	Imparts banana, pear, butter flavor.
Butyl acetate	Imparts pear, raspberry, pineapple flavor.
Cinnamyl propionate	Imparts strawberry, raspberry, grape flavor.
Ethyl acetate	Imparts fruity ethereal flavor.
Ethyl anthranilate	Imparts grape winelike flavor.
Ethyl benzoate	Imparts strawberry, cherry flavor.
Ethyl butyrate	Imparts pineapple flavor.

Ethyl formate	Imparts apricot, peach, pineapple flavor.
Ethyl propionate	Imparts apple, pineapple flavor.
Ethyl sebacate	Imparts grape, peach flavor.
Ethyl valerate	Imparts apple, peach, pineapple flavor.
Ethyl oxyhydrate	Imparts rum ether flavor.
Ethyl anthranilate	Imparts grape flavor.
Isobutyl acetate	Imparts raspberry flavor.
Methyl anthranilate	Imparts grape flavor.
Methyl ionone	Imparts raspberry, strawberry flavor.
Methyl salicylate	Imparts wintergreen, root beer flavor.

HIGHER ALDEHYDES, ALCOHOLS, ETC.

Oenanthic ether	Imparts artificial cognac flavor.
Phenyl ethyl butyrate	Imparts strawberry, raspberry, peach flavor.
Phenyl acetic aldehyde	Imparts apricot, cherry, pistachio flavor.
Phenyl butyl ketone	Imparts cherry, peach, strawberry flavor.
Phenyl ethyl cinnamate	Imparts peach, apricot, cherry flavor.
Rhodinol butyrate	Imparts in traces, cherry, raspberry, strawberry flavor.
Octyl alcohol C_8	Imparts rose, tuberose flavor.
Nonyl alcohol C_9	Imparts lemon, lime, orange flavor.
Decyl alcohol C_{10}	Imparts orange flavor.
Undecyl alcohol C_{11}	Imparts lilac, lily flavor.
Duodecyl alcohol C_{12}	Imparts lemon, orange flavor.
Heptyl aldehyde C_7	Imparts strawberry flavor.
Octyl aldehyde C_8	Imparts jasmine, rose flavor.
Nonyl aldehyde C_9	Imparts orange, lemon, lime flavor.
Decyl aldehyde C_{10}	Imparts citrus flavor.
Undecyl aldehyde C_{11}	Imparts lily, violet flavor.
Duodecyl aldehyde C_{12}	Imparts orange, lemon, lime flavor.
Peach aldehyde C_{14}	Imparts cherry, peach, plum flavor.
Apricot aldehyde C_{15}	Imparts apricot, peach flavor.
Strawberry aldehyde C_{16}	Imparts raspberry, strawberry flavor.
Cherry aldehyde C_{17}	Imparts cherry pit-like flavor.
Cocoanut aldehyde C_{18}	Imparts cocoanut flavor.
Pineapple aldehyde C_{19}	Imparts pineapple flavor.
Raspberry aldehyde C_{20}	Imparts raspberry, cherry, currant flavor.
Fruit aldehyde C_{22}	Imparts fruity flavor.
Citral	Imparts imitation lemon flavor.
Diacetyl	Imparts butter flavor.

VOLATILE OR ESSENTIAL OILS

For all practical purposes volatile or essential oils may be defined as being aromatic, oily, generally liquid but sometimes semi-liquid or solid. The oils volatilize or, upon heating, evaporate without decomposition.

Essential oils may be prepared as follows:

1. By pressure, as the oils of lemon, lime, orange and grapefruit.
2. By distillation with water, or passing a current of steam through a distilling flask containing the matter to be extracted.
3. By fermentation and subsequent distillation with water, as with essential oils of mustard and bitter almonds. These seeds contain no ready essential oil so they are crushed, left in contact with water, and, due to the action of nitrogenous ferments, the essential oil is formed. This is then recovered by distillation with water.
4. By transferring scents of various plants by immersion in a fixed oil devoid of odor, such as olive oil or lard. The aromatic odor is finally collected by extraction with ethyl alcohol, is used as is or re-distilled.
5. By extraction with low boiling solvents, either by percolation or maceration, recovering the solvent by distillation, and collection of the essential oil.

The component ingredients of essential oils consist of terpenes, aldehydes, ketones, acids, phenols, alcohols, esters, ethers, and sulphur compounds. Essential oils, generally, are liquids lighter than water but there are quite a number that are heavier.

ESSENTIAL OILS

Angelica oil

Solubility in alcohol: 1 part in 12 parts of 90% strength.
Use: Gin, cordials, flavors, spicy.

Anise oil

Solubility in alcohol: 1 part in 3 parts of 90% strength.
Use: Licorice candy, cordials, sweet.

Bergamot oil

Solubility in alcohol: 1 part in 2 parts of 80% strength.
Use: Flavoring medicines and perfume.

Birch tar oil

Solubility in alcohol: 1 part in 3 parts dehydrated alcohol.
Use: Flavor in leather, soap, for insect bites.

Bitter almond oil

Solubility in alcohol:	1 part in 2 parts 70% strength.
Use:	Cherry syrups, almond flavor.

Bitter orange oil

Solubility in alcohol:	1 part soluble in 5 parts 95% strength.
Use:	Orange flavor.

Calamus oil

Solubility in alcohol:	1 part in 2 parts 70% strength.
Use:	Spice.

Cardamom oil

Solubility in alcohol:	2 parts in 5 parts 70% strength.
Use:	Cordial, spice.

Cassia oil

Solubility in alcohol:	1 part in 2 parts 80% strength.
Use:	Fountain flavors, spicy.

Caraway oil

Solubility in alcohol:	1 part in 8 parts 80% strength.
Use:	Cordial, spice, kummel.

Cedar oil

Solubility in alcohol:	1 part in 6 parts 95% strength.
Use:	Rum, tobacco-like flavor.

Carrot oil

Solubility in alcohol:	1 part in 5 parts 95% strength.
Use:	Soups, carrot-like flavor.

Celery oil

Solubility in alcohol:	1 part in 8 parts 90% strength.
Use:	Fountain syrup, soup.

Cinnamon oil

Solubility in alcohol:	1 part in 3 parts 70% strength.
Use:	Flavors, spicy.

Clove oil

Solubility in alcohol:	1 part in 2 parts 70% strength.
Use:	Flavor, spicy.

Chamomile roman oil

Solubility in alcohol:	1 part in 2 parts 80% strength.
Use:	Flavor, vermouth, sweet aroma.

Coriander oil

Solubility in alcohol:	1 part in 3 parts 70% strength.
Use:	Cordial, flavor, spice.

Cognac

Solubility in alcohol:	1 part in 8 parts 80% strength.
Use:	Whisky flavors.

Fennel oil

Solubility in alcohol:	1 part in 9 parts 90% strength.
Use:	Licorice flavor, sweet, cordial.

Galanga

Solubility in alcohol:	1 part in 7 parts 95% strength.
Use:	Ginger, camphor-like.

Ginger oil

Solubility in alcohol:	1 part in 7 parts 95% strength.
Use:	Ginger ale, spicy.

Juniper oil

Solubility in alcohol:	1 part in 4 parts 95% strength.
Use:	Gin flavors.

Hop oil

Solubility in alcohol:	1 part in 1 part 95% strength.
Use:	Beer flavor, coffee, maple, celery.

Lemon oil

Solubility in alcohol:	Clearly soluble in 95% strength, forms cloudy liquid in weaker concentrations.
Use:	Lemon flavor drinks, bakery goods.

Lemon oil; terpeneless

Solubility in alcohol:	Clearly soluble in 80% strength. Maybe as much as 14 times stronger than lemon oil. Will not oxidize.
Use:	Especially recommended for flavoring baking goods, gelatin and drink powders.

Lovage oil

Solubility in alcohol: 1 part in 3 parts 80% strength.
Use: Condiments, maple flavor, foods.

Lime oil

Solubility in alcohol: Clearly soluble in 95% strength, forms cloud in 90%.
Use: Lime drinks, ginger ale, candy flavor.

Laurel oil

Solubility in alcohol: 1 part in 2 parts 70% strength.
Use: Strongly aromatic, camphor-like, used in liquors.

Mace oil

Solubility in alcohol: 1 part in 3 parts 90% strength.
Use: Doughnut flour, liquors, foods.

Marjoram oil

Solubility in alcohol: 1 part in 1 part 85% strength.
Use: Food seasoning.

Mandarin oil

Solubility in alcohol: Clearly soluble in 95% strength.
Use: Called tangerine oil, in orange flavors for bouquet.

Neroli oil: (orange flower oil)

Solubility in alcohol: 1 part in 2 parts 80% strength.
Use: In imitation flavors and perfume, bitter-like.

Neroli: (Portugal oil)

Solubility in alcohol: Clearly soluble in 95% strength.
Use: The pressed oils are, Italian, West Indian and Californian. There also is the extracted kind. For flavor tone in soft drinks, perfume, orange-like odor.

Nutmeg oil

Solubility in alcohol: 1 part in 3 parts 90% strength.
Use: Doughnut flour, soft drinks.

Orris oil

Solubility in alcohol: 1 part in 1½ parts 80% strength.
Use: Fruit flavors, violet-like odor.

Origanum oil

Solubility in alcohol:	1 part in 3 parts 70% strength.
Use:	Liquors, sometimes used where thyme is called for.

Pennyroyal

Solubility in alcohol:	1 part in 2 parts 70% strength.
Use:	Stimulant, protection against insect bites.

Palmarosa oil

Solubility in alcohol:	1 part in 3 parts 70% strength.
Use:	Honey flavor, has sweet taste.

Peppermint oil

Solubility in alcohol:	1 part in 4 parts 70% strength.
Use:	Candy flavor, chewing gum. There are Japanese, English and American grades, the Japanese quality being used for medicinal purposes primarily. Cooling to taste.

Parsley oil

Solubility in alcohol:	1 part in 7 parts 70% strength.
Use:	Spice flavor, bitter.

Pepper oil

Solubility in alcohol:	1 part in 12 parts 90% strength.
Use:	Food flavor.

Peru oil

Solubility in alcohol:	1 part in 3 parts 90% strength.
Use:	Food flavors, sweet and aromatic.

Pettigrain oil

Solubility in alcohol:	1 part in 1½ parts 80% strength.
Use:	Liquors, gin, lemon-like bitter aromatic.

Pimento oil

Solubility in alcohol:	1 part in 2 parts 70% strength.
Use:	Food flavor.

Rose oil

Solubility in alcohol:	Soluble in 90% strength with formation of cloud. This is due to separation of paraffin hydrocarbons.

Use:	Food flavors, perfumes. Prepared from red and white roses, in Germany, Bulgaria, and France.

Rose geranium oil

Solubility in alcohol:	1 part in 3 parts 70% strength.
Use:	Flavor, perfume. Varieties are Reunion, African, French, and Spanish Geraniums, also Bourbon. Pleasant rose-like odor.

Sassafras oil

Solubility in alcohol:	1 part in 2 parts 90% strength.
Use:	Food flavor, perfume in soap making.

Spearmint oil

Solubility in alcohol:	1 part in 1 part in 80% strength.
Use:	Food flavor, chewing gum.

Star anise oil

Solubility in alcohol:	1 part in 3 parts 90% strength.
Use:	Cordials, vermouth, sweet licorice flavor.

Sweet birch oil: (Wintergreen)

Solubility in alcohol:	1 part in 7 parts 70% strength.
Use:	Root beer, liniments.

Thyme oil

Solubility in alcohol:	1 part in 2 parts 80% strength.
Use:	Seasoning flavor.

Wormwood oil

Solubility in alcohol:	1 part in 2 parts 80% strength.
Use:	Liquors, cordials.

Ylang-ylang oil

Solubility in alcohol:	1 part in 2 parts 90% strength.
Use:	Fruit flavor resembling pineapple, peach.

From the following table of equivalents one can readily calculate the quantity of essential oil represented by a known weight of spice.

Quantity	*Spice*	*Ess. Oil*
100 lb.	Allspice	3½ lb.
100 lb.	Bitter Almonds	½ lb.
100 lb.	Angelica root	¾ lb.
100 lb.	Angelica seet	1 lb.
100 lb.	Anise seed (Russian)	2½ lb.
100 lb.	Anise star (Chinese)	3 lb.
100 lb.	Calamus root	2½ lb.
100 lb.	Caraway seed	5 lb.
100 lb.	Cardamom seed	5 lb.
100 lb.	Cassia cinnamon	1 lb.
100 lb.	Celery seed	3 lb.
100 lb.	Cinnamon ceylon	1 lb.
100 lb.	Cloves	17 lb.
100 lb.	Coriander seed	½ lb.
100 lb.	Cumin seed	3 lb.
100 lb.	Dill seed	3½ lb.
100 lb.	Estragon	½ lb.
100 lb.	Fennel seed	5 lb.
100 lb.	Horse radish	1 oz.
100 lb.	Laurel leaves (bay)	2 lb.
100 lb.	Lovage root	½ lb.
100 lb.	Mace	12½ lb.
100 lb.	Mustard seed	¾ lb.
100 lb.	Nutmeg	12½ lb.
100 lb.	Parsley seed	3 lb.
100 lb.	Sage	2 lb.
100 lb.	Sweet basil	3/20 lb.
100 lb.	Sweet marjoram	½ lb.
100 lb.	Wild marjoram	2 lb.
100 lb.	Thyme	2 lb.
100 lb.	Valerian root (oleoresin)	1 lb.
100 lb.	Black pepper (oleoresin)	6 lb.
100 lb.	Capsicum (oleoresin)	8 lb.
100 lb.	Ginger (imitation flavor)	10 lb.
100 lb.	Garlic (imitation flavor)	4 oz.
100 lb.	Onion	4 oz.

The oil can be added directly to the products and distributed during the mixing operation or, if the quantity of oil is small, it can be mixed with a quantity of a fixed oil, such as corn oil, to increase the bulk to a desired quantity.

Thus, a calculated amount, say 3 drams 49 minims, can be dissolved in sufficient corn oil to make the entire bulk one fluid ounce, which would be the quantity to add and would contain just the 3 drams 49 minims of the flavoring oil.

Other methods are also applicable. An emulsion can be made in calculated proportions for the addition of any desired quantity to a batch. Or, the oils can be absorbed on salt, sugar, flour, starch, or any other dry material used in the process.

For pickle makers, a solution of the oil in 75% acetic acid forms a terpeneless solution of the flavor bodies that is readily distributed in the various liquors and products.

SUGGESTED USES OF SYNTHETIC AND NATURAL AROMATIC CHEMICALS IN FLAVOR FORMULAE

Acetaldehyde 50%	Use less than 10% in apple, peach, and apricot formulae.
Aldehyde C_{10}	Use less than ½% in orange and lemon formulae.
Aldehyde C_{14}	Use less than 3% in peach and apricot formulae.
Aldehyde C_{16}	Use less than 10% in strawberry and raspberry formulae.
Benzyl butyrate	Use less than 3% in strawberry and raspberry formulae.
Benzyl formate	Use less than 2% in raspberry and cherry formulae.
Benzyl propionate	Use less than 2% in raspberry and cherry formulae.
Benzyl phenyl acetate	Use less than 3% in honey formulae.
Benzyl propyl acetate	Use less than 30% in banana formulae.
Butyl acetate	Use less than 20% in raspberry, pineapple, and grenadine formulae.
Butyl anthranilate	Use less than 5% in grape formulae.
Butyl butyrate	Use less than 5% in banana, butter, and pear formulae.
Cinnamyl anthranilate	Use less than 12% in grape formulae.
Cinnamyl butyrate	Use less than 5% in grape, raspberry, and strawberry formulae.
Cinnamyl formate	Use less than 2% in peach, raspberry, and strawberry formulae.
Cinnamyl propionate	Use less than 5% in grape, raspberry, and strawberry formulae.
Diethyl anthranilate	Use less than 20% in grape formulae.
Ethyl anthranilate	Use less than 25% in grape formulae.
Ethyl lactate	Use for taste in grape and wine flavor.
Ethyl methyl anthranilate	Use less than 25% in grape formulae.
Ethyl cinnamate	Use less than 2% in strawberry and raspberry formulae.
Ethyl pelargonate	Use as substitute for cognac oil.
Geraniol, pure absolute	Use less than 5% for rose notes, peach, strawberry, raspberry, grenadine and apple formulae.

Geranyl acetate	Use less than 3% in apple formulae.
Geranyl formate	Use less than 3% in apple formulae.
Isobutyl acetate	Use less than 20% in raspberry, banana, and grenadine formulae.
Isobutyl benzoate	Use less than 1/4% in raspberry and strawberry formulae.
Isoeugenol	Used in strawberry and raspberry formulae.
Jasmin synthetic	Use less than 10% in strawberry, raspberry, cherry, and other flavors where fruity tones are desired.
Linalool	Use less than 3% in lemon, lime, pineapple, banana, orange, and honey formulae.
Linalyl acetate	Use less than 5% in apricot, peach, strawberry, lemon, and lime formulae.
Linalyl formate	Use less than 3% in peach and apricot formulae.
Methyl anthranilate	Use less than 20% in grape formulae.
Methyl isoeugenol	Use less than 3% in raspberry and strawberry formulae.
Oenanthic ether	Use less than 15% in cognac, grape, butter, and wine formulae.
Phenyl ethyl acetate	Use less than 5% as sweetener in fruity formulae.
Phenyl ethyl butyrate	Use less than 10% for fruity note in strawberry, raspberry, and peach formulae.
Phenyl ethyl cinnamate	Use less than 5% in peach, apricot, and cherry formulae.
Phenyl ethyl formate	Use less than 5% in strawberry formulae.
Phenyl ethyl phenyl acetate	Use less than 3% in honey, cherry, and grenadine formulae.
Phenyl propyl acetate	Use less than 1% in peach, apricot, and pineapple formulae.

TERPENELESS ESSENTIAL OILS

Terpeneless oils are manufactured from the finest essential oils. In the process of manufacturing, terpenes, pectins, waxes, etc., are removed, all of which are non-essentials from the standpoint of aroma and flavor. Terpeneless oils are, therefore, readily soluble in dilute solutions of ethyl alcohol, having the stability, flavor and odor desired by the discriminating manufacturer.

Oil bay terpeneless	For ginger ales in small amounts.
Oil bergamot terpeneless	In traces for fine citrus notes.
Oil cloves terpeneless	Used for fine flavors instead of oil of cloves. Much smoother and more soluble. Twice as strong as oil of cloves.
Oil coriander terpeneless	Used instead of oil of coriander for ginger ale where solubility and a finer note are desired.
Oil fennel terpeneless	Used instead of oil of fennel on account of easy solubility and fine note.
Oil ginger terpeneless	Largely used instead of plain oil of ginger on account of high solubility. Excellent for ginger ale of the dry type.
Oil grapefruit terpeneless	For drink powder and nectar flavor. Blends delightfully with lime.
Oil lavender flower terpeneless	For ginger ale, in small amounts.
Oil lemon terpeneless	Especially recommended for flavoring gelatin and drink powders and nectars. Economical for making extract due to high strength and solubility.
Oil limes distilled terpeneless Oil limes expressed terpeneless	Recommended for same usage as given above for lemon.
Oil mace terpeneless Oil orange terpeneless	Recommended for same usage as given above for lemon.
Oil peppermint terpeneless Oil pimento terpeneless Oil spearmint terpeneless	Used in ginger ale on account of high solubility. For high solubility and strength.

FRUIT ACIDS AND OTHER ACIDS USED IN FOOD INDUSTRIES

All fruits contain some malic, citric and tartaric acids in various proportions; malic acid is found in apples, cherries, etc., citric acid in lemons, and tartaric in grapes. Lactic acid does not belong to the true fruit acids, nor do phosphoric, acetic, benzoic, butyric, succinic, and adipic. There are exceptions such as benzoic acid, which is found in a number of fruits.

Acetic acid is a colorless liquid with a vinegar-like odor. Benzoic acid is a white crystalline solid somewhat aromatic but slightly soluble in water. Butyric acid is colorless, rancid smelling and soluble in water. The solid acids such as citric and tartaric are both soluble in water while liquid lactic and phosphoric acids, are also soluble in water.

Citric acid is the most widely used in the field of foods and beverages. It occurs abundantly in nature, in the juice of lemons and limes. Most of the citric acid now being used commercially is prepared by fermentation of sugar.

Tartaric acid is also widely used in foods and beverages. It is, however, being replaced to a considerable extent by citric acid. The acid of commerce is the d-isomer and occurs in nature in the juice of the grape. During the fermentation of this juice to wine, the acid is precipitated as the acid potassium salt and, to some extent, as the calcium salt, in crystalline deposits, termed "argols." These "argols," imported from the larger wine producing countries of the world, serve as the raw material for the production of tartaric acid.

Gluconic acid is generally sold as a solution in water and can be obtained as a white crystalline product. It is made by a fermentation oxidation of glucose and indications are that it will be a valuable addition to the list of acids used in the food industry. It has already been suggested as a mild preservative for fruit juice.

Ascorbic acid is recognized as being Vitamin C. The U. S. P. and International Units of Vitamin C are defined as 0.05 milligrams of ascorbic acid; one gram of ascorbic acid is, therefore, equal to 20,000 U. S. P. or International units. The acid is soluble in air; however, in aqueous solution it is slightly oxidized on exposure to atmospheric oxygen. The presence of even small amounts of iron or copper salts in solution accelerates the oxidation. The acid is found in citrus juice, such as lemon, orange and lime.

Solubility of fruit acids:

Citric acid	100 grams soluble in 50 grams water at room temperature.
	100 grams soluble in 180 grams alcohol at room temperature.
Tartaric acid	100 grams soluble in 76 grams water at room temperature.
	100 grams soluble in 330 grams alcohol at room temperature.
Malic acid	Possesses a similar degree of solubility as above.

Approximate percentage of acids in fruits:

Fruit	Total Acid	Summary
Apple	.71%	Malic
Banana	.26%	Malic
Cherry	1.04%	Malic
Crab apple	1.50%	Malic
Currant	2.43%	Citric mostly, malic, little.
Cranberry	2.73%	Citric mostly, malic, little.
Cantaloupe	.18%	Citric
Grape	1.00%	Tartaric
Gooseberry	2.12%	Malic and citric
Lemon	6.50%	Citric
Orange	1.35%	Citric
Pineapple	.75%	Citric
Peach	.75%	Malic
Persimmon	.09%	Malic
Pomegranate	4.52%	Citric
Plum	1.27%	Malic
Quince	1.22%	Malic
Raspberry	1.51%	Citric
Strawberry	1.00%	Citric
Watermelon	.20%	Malic

RESINS AND BALSAMS

Resins represent a class of natural vegetable products composed of carbon, hydrogen and oxygen. They are closely allied to the essential oils, all of which, when exposed to the air, absorb oxygen and are finally

converted to substances having the characteristics of resins. In most cases they are obtained from plants which yield them mixed with, and dissolved in, a corresponding essential oil. They are insoluble in water, but dissolve in alcohol, ether and in other essential oils. Many of them possess acid properties and form frothy solutions in alkalies. The resins are divided into three groups:

A. Hard or true resins
B. Oleo-resins, soft resins and balsams
C. Gum resins

The hard resins are solids at room temperature and contain little or no essential oil. Under this head are included:

Copal
Amber
Colophony or common resin
Dammar or kauri resin
Lac resin (stick lac-seed lac-shellac)

The above are not volatile, fuse when heated, and are soluble in carbon tetrachloride, chloroform, fixed and volatile oils.

Resins which exude from the cell ducts or from the plant itself, and are usually accompanied by the volatile oil itself are classified as follows:

Dragon's Blood
Mastic
Sandarac
Guaiac resin
Benzoin (from styrax benzoin)

The oleo resins, or soft resins, are mixtures of resins and volatile oils. The ones containing benzoic or cinnamic acids in addition to the resins are generally called balsams and have a vanilla-like aroma.

Peru balsam, comes from a tree in Central America, balsamic odor.
Tolu balsam grows on a tree in Venezuela.
Storax (styrax) grows on a tree in Asia Minor and Syria.
Turpentines (Canada balsam, Venice turpentine)
Burgundy pitch
Copaiba balsam
Elemi

The gum resins are milky exudations from plants and contain gum which is entirely or partly soluble in water and alcohol. Many of these resins contain essential oil. They are:—

Galbanum	Gamboge
Asafetida	Scammony
Olibanum	Euphorbium
Myrrh	

There are also so-called "manufactured oleo resins," that is, the seed, plant, root, or bark is extracted with ethyl alcohol or other suitable solvent, by which all the volatile and aromatic principles are carefully separated in the form of resins. These are then very readily soluble in alcohol.

Benzoin	Aromatic addition to beverages.
Capsicum	Spicy
Cubebs	Spicy
Celery	Made from the seed.
Cherry bark wild	Blends well with vanillin.
Coffee	Blends well with other flavors.
Gentian	Good base for bitters.
Ginger Jamaica	Ginger ale.
Haw	Good in maple flavor.
Hops	Good with oil of hops.
Horehound	Good for cough drops.
Lemon peel	True flavor.
Licorice	Maple flavor conditioner.
Lovage	Condiments, truer flavor than the oil.
Olibanum	Flavor to beverages.
Patchouly	Candy flavor.
Orange peel	True in flavor, produces natural cloud.
Opoponax	Good addition to beverages.
Orris	Spicy
Paprika	Spicy
Peru	Aromatic addition.
Phoenugreek	Maple flavor.
Sassafras	Used in root beer, birch beer and sarsaparilla.
Tonka	Fixative for vanilla.
Vanilla	For making vanilla flavor.

SPICE AND FLAVOR AIDS

Taste is allied to the sense of smell. It is the immediate contact of the substance with the tongue that informs us whether the produce is good or just ordinary. Taste is but one of the five senses, and it happens to be the most sluggish of them all. There are many kinds of taste such as sweet,

sour, bitter and salty, and each in itself may excite the appetite whereby the amount of food consumed may be increased. It is important that the taste be pleasant and agreeable and in harmony with the food. The many basic materials herein described can be compounded into various foods. The transfer of flavor may be realized by dissolving essential oils, ethers, esters, vanillin, etc. in ethyl alcohol, or by adding the flavor in emulsion form. Thorough mixing together of flavor and sugar, and then adding gradually to the foodstuff is an inexpensive way of introducing flavor.

Flavoring ingredients are sometimes susceptible to oxidation, which would then impart an off odor, or rancid taste. Anti-oxidants can be used to prevent or retard this development. Fatty food preparations are the ones to watch for rancidity or flavor change, and should be fortified with these anti-oxidants. With but few exceptions, cane sugar, dextrose, honey, molasses and corn syrup, are the usual sweetening agents used in foods. Sour taste is due to the presence of acids, which may be of organic or mineral origin. The so-called "fruit acids" commonly used are citric, tartaric and malic. A sour taste is generally refreshing and, with the addition of sugar, aids in rounding out the taste.

A salty taste is necessary for foods, in that it increases palatability, whereas a bitter taste stimulates and excites the appetite and promotes digestion. Aromatic substances are also stimulating food additions. No household or food factory could possibly get along without these invaluable spices. In general, flavors, salt and spices are necessary helpmates, without which many foods would be uninteresting. In themselves, these food adjuncts may have little nutritive value, but they render foods enjoyable to the taste and stimulate lazy appetites.

Spices are aromatic, often pungent, vegetable substances used chiefly for the seasoning of food. They are derived from different parts of their respective plants. They may be contained in the stems, leaves, buds, flowers, barks, root stock, seeds and immature or ripe fruits. As an example, ginger is a root stock, cinnamon the inner bark, cloves are flower buds, nutmegs the seeds, and sage, thyme and other herbs comprise the entire upper part of the plant. Their aromatic qualities are contained chiefly in their essential oils.

Condiments are manufactured foods composed of spices, sweetening agents, thickeners; they may be salty, spicy or aromatic. These products are also made with vinegar, sauces and various collections of pickles. The addition or use of condiments to foods rounds out the taste and improves the flavor.

SPICES AND CONDIMENTS

For convenience the spices and condiments may be classified with reference to the source from which they are obtained. Thus:

I. From Stems or Leaves

Bay Leaf	Peppermint
Burnet	Parsley
Sage	Chervil
Spearmint	Tarragon
Sweet Marjoram	Wintergreen
Sweet Basil	Chives
Savory	Thyme

II. From Buds and Flowers

Capers	Saffron
Cloves	

III. From Barks

Cassia	Cinnamon

IV. From Roots and Root Stocks

Turmeric	Sassafras
Garlic	Onion
Ginger	Shallot
Horseradish	

V. From Immature and Ripe Fruits

Allspice	Juniper
Capsicum	Pepper
Paprika	Vanilla

VI. From Seeds

Tonka	Dill
Bitter Almond	Fennel
Anise	Grains of Paradise
Cardamom	Mustard
Caraway	Nutmeg
Coriander	Mace
Celery	Foenugreek
Cumin	

ALLSPICE:

Allspice is the fruit of a West Indian tree. It is about the size of a small pea and is gathered when fully grown and nearly ripe. It is then

sun dried. It is called allspice because of its resemblance in flavor to a mixture of "all spices," particularly cinnamon, nutmeg and cloves. It is also known as pimento because of its resemblance to the peppercorn, and also as Jamaica pepper because it is largely grown in Jamaica.

ANGELICA:

This is an aromatic plant, native to the Alps and growing freely in many parts of Europe as far north as Iceland and Lapland. In the latter countries the fleshy roots and stalks are used respectively for food and medicine. Commercially the young and tender leaf stalks are candied and are used for decorating candies and cakes.

ANNATTO:

This is a seed-like material extracted from the reddish pulp which surrounds the seeds of the annatto tree. It is a yellowish-red dye used for coloring butter, cheese, ice cream and liquors, and is found principally in South America and the West Indies. It is exported in cakes of two or more pounds in weight and wrapped in leaves.

ANISEED:

A small seed of an annual plant cultivated chiefly in Spain, Egypt, Syria, Mediterranean countries and in Germany. It is used as a condiment, for medicine, flavoring candies and syrups.

ANISE:

The fruit of the Chinese tree known as star or Chinese Anise, or Badian, is similar in flavor and properties to the common anise, but is very different in appearance, being star shaped. In China it is often added to tea.

BASIL:

Basil is a widely distributed, highly aromatic and sweet herb native to India. Is used especially in turtle soups and its flavor resembles that of the clove. Basil vinegar is made by steeping basil leaves in the liquid. Mountain mint is sometimes called basil.

BAY LEAVES:

The leaves are aromatic and come from the sweet bay or laurel tree, growing wild in Greece, Italy, Mediterranean countries and in some southern sections of the United States. The principal consumption is of the dried leaf used for flavoring soups, pickles, fish products, etc.

Sweet bay and its leaves have no connection with bay rum. It is the bayberry leaves when distilled with rum that give the well-known flavor of bay rum.

BURNET:

This is a perennial garden herb whose young leaves are used for flavoring soups and in salads, suggesting the cucumber in flavor. When crushed with other mild spices, like chervil or parsley, it lends a splendid flavor.

CAPERS:

Capers are pickled flower buds of the caper bush growing in countries along the Mediterranean and in India. They are used as pickles and added to sauces. After the crop is gathered they are carefully dried and then stored in barrels of brine or vinegar, the latter being sometimes flavored with tarragon sprigs, elder flowers, cloves or peppercorns. During the following winter the capers are grated through sieves, the smallest ones having the best quality. They are then replaced in the barrels and thus preserved until sold. Before shipment they are washed in vinegar to make them firm, the ones of finer qualities being repacked in small bottles. The buds of the bean-caper and nasturtium are sometimes used for adulteration.

CARAWAY SEEDS:

These are deep brown seeds of an aromatic plant which grows wild in Holland, Germany and many other countries, including the United States, especially California. They are utilized as a culinary flavor, in confections, liquors and in rye bread. The oil distilled from the seed is used chiefly in making perfume and in compounding household flavoring extracts. The root of the caraway plant resembles parsnips and serves as an excellent vegetable when young and tender. The young shoots may be used for flavoring soups and stews.

CARDAMOM:

This is a three celled, ovate, triangular yellowish pod, enclosing a number of small, dark, wrinkled angular seeds, with an aromatic and agreeably pungent flavor. The cardamom fruit is native to India and Jamaica. The seeds are used for culinary purposes, confections, flavoring extracts, etc. Other cardamoms similar in character come from several East Indian plants of the Amomum genus, especially the round or cluster cardamom, the Siamese bastard cardamom, and the Java cardamom.

CASSIA-BUDS:

These are the dried flower buds of the tree which yields cassia cinnamon. The flavor is similar to that of cinnamon. In appearance they somewhat resemble cloves.

CHERVIL:

This is an aromatic, low growing herb cultivated in all temperate climates and very popular in the south. The young leaves are used for seasoning soups and salads. It resembles parsley.

CASSIA:

Cassia is obtained from China and the Dutch West Indies, and is darker in color, rougher in appearance and about four times as thick as true cinnamon. Cassia is a bark, the heaviest parts of which are ground, and the thinner ones used whole. Its flavor is more strongly pronounced than cinnamon. The best grades in order are Saigon, Batavia, and China.

CHILI: (CHILIES)

This consists of the pods of several species of small, fruited, pungent capsicums. The name is an adoption from the Mexican, and Chilies are prepared, both ripe and unripe, as a separate ingredient to be added to mixed pickles. They are extensively consumed in hot countries; the two Mexican dishes containing them are known as chile con carne and chicken tamale. Chili is also used as a group name for highly seasoned condiments made either with whole capsicums or pepper.

CHILI CON CARNE:

This is a Mexican dish very popular in the southwest, the chief components of which are beef, beans, chili, garlic and spices.

CHIVES:

This is a plant of a species allied to the onion and leek, cultivated principally for the leaves, which grow in thick tufts resembling grass, but are hollow like onion leaves. Chives can be used as a substitute for onions, especially in soups, stews and salads.

CELERIAC: (Knob celery, turnip celery or German celery)

This plant is cultivated solely for its large turnip-like roots. It is grown principally in Europe, is eaten as a separate vegetable or added to soups, stews and salads for flavor. When served as a salad, it is boiled, sliced, and served with oil, vinegar or other desired ingredients.

CELERY:

Celery is a cultivated plant, found wild in many parts of this country and Europe. The present varieties are all of modern development, being constantly improved to meet the demands of an ever expanding market. At one time an expensive article, in recent years it has become a product of general consumption with a lowering of price. It is grown in California, New York, Michigan and many other states.

Celery requires constant care for cultivation; rich, moist and soft mucky soil gives the best qualities. Every part of the plant is used to advantage, the stalks being eaten raw or in salads; the trimmings, fresh or dried, are excellent for flavoring broths.

CELERY SEEDS:

These seeds are used for celery salt and numerous pickles and seasonings. Imported from France, they are also used for flavoring soups.

CINNAMON:

This is the inner bark of young wood of a cinnamon tree. Ceylon cinnamon is chiefly of Ceylonese cultivation; cassia cinnamon is the principal East Indian and Chinese type. Both varieties are sold in quill form and then ground. Its fragrant aromatic flavor makes cinnamon a popular adjunct to cookery, etc. Ceylon cinnamon has a pale yellowish-brown color, its quills being lighter, cleaner and smoother in appearance than those of cassia. One specific trade difference between cinnamon and cassia is that the latter has a single quill, whereas the former has many quills enclosed in an envelope. In the ground it is frequently impossible to tell the difference, especially if the cassia is of good quality. The cinnamon tree is also cultivated in Java, Sumatra and tropical Asia.

The preparation of cinnamon is simple. The branches, about one inch in thickness, are cut and trimmed to a length of four feet when the bark is ripe. The bark is stripped, peeled and cut down two sides with a sharp pointed, slightly hooked knife, and after a little gentle prying, is pulled off in two long strips. The strips are piled in heaps and allowed to ferment. The outer skin is then removed, exposing the pale yellow inner bark, which is the cinnamon itself. The strips are now permitted to dry for half an hour and are then formed into the quills, in which form they are marketed.

CLOVES:

Widely used for flavoring confectionery and desserts, cloves are the dried flower buds of the clove tree. When plucked they are reddish, but change to brown in the process of drying, this process being performed

by the smoke of wood fires or the sun. The cloves contain about 18% of volatile oil. The principal sources of supply are Zanzibar and the East Indies. The flower buds, upon drying or curing, lose about 50% of their weight. The best cloves should be large, plump, purplish-brown in color, and unbroken.

CORIANDER SEEDS:

This is the smooth, round, yellowish or brownish seed of an annual plant, native to Germany, Hungary, Italy and Asia. It is a little smaller than the peppercorn. The best seeds have a yellow color, while the poorer quality are brown or black. They have a spicy taste and odor and are used in cakes, cordials and, in Scotland, as a popular sugar coated candy.

CUMIN SEEDS:

This is an herb of the caraway type, producing seeds of aromatic odor and flavor, popular in Europe and Asia, but little used here except in curry powders. In Germany the seeds are particularly liked for flavoring bread, in Holland for cheese, and in Norway for anchovies and as additions to soup, pastry and pickles. They are used by meat packers for sausage flavoring.

CURRY POWDER:

This is a highly seasoned condiment extensively used in India and other Eastern countries. In India and Ceylon it commonly consists of black and cayenne peppers and a number of spices, e.g., nutmeg, cinnamon and cloves, made into a powder or paste with tumeric. Curry powders sold here usually contain additional ingredients, such as coriander seed, fenugreek seed, cumin and ginger.

DILL SEEDS AND LEAVES:

The dill is a hardy, easily grown herb cultivated chiefly for its aromatic, pungent seeds which are employed in the manufacture of pickles and sauces. The leaves, resembling the combined flavor of fennel and mint, are used for their flavor quality. The plant is grown in the United States, southern Europe, Egypt and South Africa.

DULSE:

This is an edible, purplish-red seaweed abundant along the New England coast. It is eaten raw as a relish. It may be plain boiled (either fresh or dried) or cooked in butter or milk. It is served as a vegetable with fish or meat and added to stews.

FENNEL:

The fennel is chiefly cultivated for its young leaves which are excellent additions to salads and garnishes. It is known as the common garden or sweet fennel. The seeds are used for seasoning, and contain from 3 to 7% of an ethereal oil called anethol. The seeds are sweet and spicy; are used in medicine and food.

FENUGREEK SEEDS: (FOENUGREEK)

These seeds are the fruit of an annual herb, from one to two inches in length, brownish-yellow, with a peculiar odor, bitter in flavor and mucilaginous. In Egypt they are used as flour in breadmaking, and in Greece are added to honey. The seeds are $\frac{1}{8}$ inch long, have a strong, unpleasant, aromatic odor suggestive of the onion. They are used in the preparation of imitation maple.

GALANGAL:

This is the aromatic rootstock of several plants of the ginger family imported chiefly from China. At one time it was used extensively as a spice and in medicine.

GARLIC:

The garlic is similar to the onion in odor, but the bulb is white skinned or rose tinged and divided into ten or twelve sections known as cloves. At certain seasons garlic abounds in many pastures, imparting a rank flavor to the milk and butter of cows which feed upon it. Its main uses are in flavoring soups, sauces, salads, and pickles. It is an important ingredient in many food combinations used in southern Europe. The plant is native to Italy, France, Spain, and is also grown in the United States. The strong flavor is due to an oil which is rich in sulphur.

GINGER:

Ginger is the rootstock or rhizome of a perennial reed-like plant with annual leafy stems, three to four feet high which grows freely in most tropical places. The rootstocks are gathered when the stalks wither. There are two kinds of ginger found in commerce. The first is the coated, or black, ginger with its wrinkled surface. These roots are scalded or washed and then allowed to dry in the sun; this method is usually employed for the older, poorer roots. The second kind, uncoated or white ginger, is washed after scraping. The natural color of white scraped ginger is a pale buff, often whitened by bleaching or treating with lime water. This method sometimes reduces its quality.

First grade white ginger should be large, light buff, soft and of strong characteristic flavor. The present supply comes chiefly from Jamaica, the Malabar coast of India, East Indies, Africa, China and Japan. Ginger coming from Africa is dark and coarse in texture, but has an excellent strong flavor, and is largely used in the manufacture of ginger ale extracts. Japan ginger is usually bleached or limed before shipment, is of finer appearance, large, smooth but is inferior in strength. Green ginger has not been scraped, washed or dried, and is used by preservers.

Ginger which has been preserved in sugar syrup, also known as Canton or sugar-candied ingber or ginger, consists of young green roots which previous to curing with sugar have been macerated with seawater. Preserved ginger is sold in tins and jars, the imported Chinese product being highly prized. Crystallized ginger is also made from the young root. Flaked ginger is sold as leaf ginger; other ginger products are ginger beer, ginger tea and Jamaica ginger, a good stimulant frequently employed for dyspepsia and colic.

HOPS:

Hops have been cultivated in France and Germany as early as the eighth century and are now also planted in the United Sttaes, the producing sections being New York and the Pacific Coast states. The hop is the fruit of a climbing plant also found wild in Europe and Asia. It is a multiple fruit consisting of an oblong, oval, or conical mass of dry overlapping scales, as in pines, spruce, firs, etc., and imparts the distinctive flavor to beer beverages. Hops are used in compounding a large number of essential oil extracts. The essential principle is the yellowish powder, lupulin. In selecting choice hops those full of lupulin, free from mold, bright silky in appearance, rich in odor, free from leaves, stems, scale, or sticks, and which when rubbed between the hands imparts a yellowish glint and gummy feeling to the skin, should be selected. The hops are harvested in the latter part of August, cured, kiln dried and then baled.

HORSERADISH:

This is a plant grown in many temperate countries, essentially for the white flesh of its very pungent root, one half to two inches in diameter, and a foot or more in length. The root also grows in the United States, especially in New Jersey, Long Island, Missouri, and the northwest. It is grated, mixed with vinegar and used as a condiment with oysters, meat and fish dishes. The strong taste and odor is due to an oil rich in natural sulphur compounds. Grated horseradish, packed in vinegar in bottles, loses its pungency in about three to four weeks, becomes dark and takes

on an earthy odor. The roots are easily grown and cared for, and may be left in the ground over the winter and dug up as needed. They may then be kept fresh for some time by burying in cool sand. The root should not be exposed to the sun or air. Horseradish powder is prepared by cleaning, then grating the root, drying with gentle heat or dry hot air. Protection and care should be taken for the eyes when grating the root.

HYSSOP:

This is a small bushy herb of strong odor, pungent flavor; the green young parts are sometimes used in salads or boiled as a vegetable. The dried flowers are pulverized and employed to flavor soups. The dried flower spikes, cut just before opening, are used in hyssop tea and in home made cough mixtures.

JUNIPER BERRIES:

This is the dried aromatic berry, generally blue, growing in numerous varieties on this continent and throughout much of the eastern hemisphere. They are too pungent for eating raw, but they impart a very nice flavor to corned beef, and the small wood of the shrub is used for smoking hams, and food flavors. The dried berries are used in large quantities to flavor gin. The oil which is distilled from the dried berry is a powerful diuretic and is used in medicine.

KOLA-NUT: (or Soudan Coffee)

The seed, not properly the nut, of Cola acuminata, a large tree of the family Sterculiaceae, native to western tropical Africa, is cultivated in the West Indies, Brazil, and other tropical countries where it has to some extent become an industry. The seeds average about an inch in length, are brown or reddish gray in color, and have an odor resembling that of nutmeg. In the tropics, especially in the Sudan, they are employed as a stimulant coffee. The seed when fully matured is about the size of a horse chestnut, but grows in pods. The natives gather them in large quantities, and use them as a tonic to conserve and promote energy. The seeds contain from two to three times as much caffein as the coffee bean. It is for this property that the seeds find favorable use in flavor extracts and beverages.

LEEK:

The leek is a culinary herb closely allied to the onion, cultivated for the branched parts of the leaves (commonly called the stems), and the bulbous roots, both of which are used in flavoring soups and stews. In

Europe the stems are served in the same manner as asparagus. The rank odor of the raw leek disappears in cooking, leaving behind a mild, onion-like flavor.

LOVAGE:

This is an aromatic plant, native to southern Europe, the root and seeds of which are aromatic, and are used in flavoring vinegar, sauces, etc. It is sometimes cultivated as a salad plant, and a minor use of the leaves is for the production of lovage oil, used as a flavoring for condiments and imitation maple flavor.

MACE:

Mace is the covering which envelops the shell surrounding the nutmeg. It is prepared for market by being flattened and dried for several days in the sun, much of it becoming reddish-yellow during the process. It is used, both in blade and ground form, as a flavoring for sauces and puddings, closely resembling the nutmeg, but being, to many tastes, even more pleasing in flavor. The mace with a deep orange color, and a clear, transparent and wax-like appearance is the choicest variety, the dull looking mace being undesirable. Mace also furnishes a yellow volatile oil, and a buttery fixed oil, the latter being known as nutmeg balsam when mixed with other substances. A product called nutmeg butter consists of the compressed oil and fatty substances derived from off-sized, spoiled, refuse nutmegs.

MARJORAM:

This is an aromatic sweet herb whose fresh and dried tops and leaves are used to flavor soups, dressings, etc. They are cut as soon as the plant begins to flower. Marjoram is a low, bushy, perennial plant grown in southern Europe, the German variety being of a darker color, but having a better flavor, than the French. The most desirable varieties are the sweet, winter sweet and pot. The common, or wild, variety of marjoram resembles the cultivated, but is coarser in flavor.

MARSHMALLOW:

The marshmallow is a tall erect plant, related to the hollyhock, native to both Europe and Asia, which grows freely around marshes near the sea. A water extract of the root and other parts results in a tasteless, odorless, mucilaginous gum, used in medicine as a demulcent for children, and also for making marshmallow candy. Today this plant is no longer used for making marshmallows, which are now being made with sugar, corn syrup, flavor and gelatin.

MATE: (or Paraguay Tea)

This consists of the leaves and young shoots of a species of holly, used widely as a tea or beverage brew in Brazil and other sections of South America. The gathering, roasting, pulverization, and breaking of the leaves and shoots is an important industrial occupation in both Brazil and Paraguay. The dry mate is greenish-yellow, with an aroma suggesting green tea. The finest quality is made of the newly opened leaf buds, a cheaper product out of the whole large leaves. The title "mate" is derived from the vessel in which the brews were formerly made. The chemical composition of mate very closely resembles that of coffee and tea, and contains the same stimulating caffein, sought for in domestic beverages.

MINT:

Mint is a name generally applied to a large number of strongly scented perennial plants cultivated chiefly for their essential oils, the best known being peppermint, spearmint, pennyroyal. About 50% of the world's commercial supply of peppermint and spearmint is produced and distilled in the acres of muckland in southern Michigan and northern Indiana. Black mint with deep green leaves is the variety most productive of peppermint oil, and black mint also has the most delicate flavor. The plants are cut when matured and in full bloom, allowed to cure like hay, then steamed in wooden vats. The heat breaks the oil cells and permits the oil to escape with the steam; the oil is then separated from the condensed water. The spearmint leaf is the ordinary mint for kitchen use, being used wet or dried. Dried mint is sold in packages, tins and bottles, and should always be kept in a dry place. Mint grows easily under almost any conditions, and if desired to be used dry, it is best to cut the stalks just prior to full bloom, spreading them out in a shady location where they can dry slowly.

MOUNTAIN MINT: (or Basil)

This is a general name for several species of a genus of perennial North American herb with aromatic leaves of a mint-like flavor. The true basil is native to India and Southern Asia.

MUSTARD:

This popular condiment is obtained by grinding and blending the velvety flour extracted from the interior of the crushed seeds of one or more species of the mustard plants; it is chiefly of the small, irregular shaped seeds (dark brown on outside, yellow on inside) of the black or brown

mustard (Brassica nigra), together with a certain portion of the smooth yellow or pale brown seeds of the white mustard (Sinapis alba).

England, Holland, Russia and Germany supply us with the best white or yellow mustard seeds. The brown seeds come from Italy, England, Russia, Holland or India. The percentage of fixed oil in mustard seed may run as low as 18% and as high as 40%. The oil is mild, tasteless, and is used to adulterate more expensive vegetable oils. The essential oil of the mustard, which gives it its pungency, is developed only when the seed comes in contact with water. The manufacture of mustard flour is somewhat similar to that of wheat flour. The black mustard flour must be blended with the yellow mustard flour to bring about the right taste and flavor. Pleasant taste and odor are sometimes more important in this condiment than pungency. A good mustard flour should contain all three qualities, blended properly.

NUTMEG:

The nutmeg is the kernel of the fruit of a tropical tree, native to the East Indies. The fruit is round and pear-like in shape, two inches in diameter, and has a reddish-yellow skin. It splits in two when mature, exposing a pink or red covering around the nutmeg kernel, which when dried is popularly known as mace. After the fruits have been gathered and the outer coverings of flesh and mace have been removed, the kernels are placed upon gratings over a slow fire and dried at about 140 degrees Fahrenheit. The nutmegs are removed from the shells as soon as they are loosened by the heat treatment, which may take as long as several weeks. After drying by exposure to the sun, they are put up in tight casks, ready for shipment. The nutmeg is a native of the Malay Archipelago, but is also cultivated in Singapore, Penang, Sumatra, Java and the West Indies. In purchasing nutmegs, the round and compact varieties, of oily appearance and greater weight, are desirable. They are graded by the number per pound (varying from 80 to 140), the largest being more showy, but those of moderate size just as good. Light weight, dried, dull fruits, or those which are long and oval, should be avoided. Grated nutmeg should be stored in a cool place. It does not keep as well as whole nutmeg.

OKRA: (or Gumbo)

Okra is a large herbaceous plant, cultivated in the southern states and the West Indies, which when dried yields a mucilaginous product, used as a thickener for soups, etc. Occasionally it is used as a substitute for coffee, after proper roasting. Iron and tin cooking utensils discolor the okra.

OLIVE:

The olive is the fruit of an evergreen tree, cultivated in all countries bordering on the Mediterranean and in the United States, chiefly in California. The fruit is green until it attains maturity, then gradually becoming yellowish, and, finally, (in most varieties) changing to a dark purplish-brown. There are numerous varieties and names, differing markedly in size and oil content. The oil content may be from 10% to 30% of the flesh of the fruit. For oil pressing it is important to use olives rich in oil, whereas in pickling the fruits rich in flesh are desirable.

The finest imported pickled green olives come from the south of Spain, whereas California and other western states lead the market in the production of the pickled ripe or black olive. California also is making much progress in the pickling of green olives. The varieties chiefly cultivated on the coast are the Mission, Manzanillo, Ascolano and Sevillano. The Manzanillo and Sevillano are Spanish varieties, the Sevillano furnishes the impotred Queen olives of Spain, and the Ascolano is an Italian strain. The Mission and Sevillano varieties are typically oval in shape, while the other two are rounded oval.

Olives used for pickling are gathered just before they have begun to change to their ripening color. They are then sorted according to size and quality, soaked in lye solution to reduce bitterness, then washed with sufficient water to remove the lye flavor and taste, and finally pickled, the method varying with the place of manufacture. In some localities brine salt solution is used, or salt and vinegar mixed; some manufacturers add a little sugar to aid fermentation; fennel, thyme, coriander, laurel leaves, etc., may also be added in small amounts. A perfect pickled olive is yellowish-green, firm, with a pinkish pit and an agreeable flavor. Inferior fruit is somewhat dark, soft, mushy, and woody tasting, these defects being caused by age or imperfect curing. Pickled or salted ripe black olives are purplish-black on the inside, dark in pulp, with a bland flavor due to the mellowing of the oil in ripening. They are treated in much the same way as the green olives to remove the bitterness, then kept in a strong brine solution under proper conditions for several months. However, the preferred method is to sterilize the dark olives in cans, after the lye treatment; this is the procedure in general use in California. Both green and ripe olives are relishes and constitute a wholesome and nutritious food. Green olives come stuffed with peppers, celery, almonds, etc., and are also sold in paste form in jars.

There are more than a dozen different sizes of olives that come from the grading machines. Most of them are listed below:

QUEENS:

70- 80's	run from	44	to	50	olives to a quart.
80- 90's	run from	51	to	56	olives to a quart.
90-100's	run from	57	to	62	olives to a quart.
100-110's	run from	63	to	69	olives to a quart.
110-120's	run from	70	to	75	olives to a quart.
120-130's	run from	76	to	81	olives to a quart.
130-140's	run from	82	to	87	olives to a quart.
140-150's	run from	88	to	94	olives to a quart.
150-160's	run from	95	to	100	olives to a quart.
160-180's	run from	101	to	108	olives to a quart.
180-200's	run from	109	to	116	olives to a quart.
240-260's	run from	151	to	162	olives to a quart.

The Manzanillas are graded in sizes similar to the Queen grades. In bottling olives both Queens and Manzanillas are used. They are either added directly to the bottle or placed in very carefully by experienced women using wooden placing tongs. The olives are washed with several changes of fresh water and covered with a 7% to 8% salt solution, to which has been added ½% to ¾% lactic acid. The lactic acid comes in liquid form of about 50% strength; it is an off-white liquid, practically odorless and now being used extensively for food manufacturing.

ONION:

The onion is a common field and garden vegetable native to southern Asia. Today it is grown in every part of the world, particularly (in large quantities) in Germany, Spain, parts of Africa, and in the United States, especially California, Texas, New York, and Ohio.

Varieties grown for the market are the white and yellow globe types and the red Wethersfield. The strong flavor and smell of the onion is due to an oil rich in sulphur compounds.

Bermuda onions are imported to this country in large quantities. They are large, mild, Spanish type of onions, and are now grown successfully in the southern states.

Spanish onion is very much like the Bermuda variety, and is also now grown in this country. The Egyptian onion is now being cultivated along the mucky banks of the Mississippi River.

The multiplier onion (also known as the potato onion) is good for flavor, represents the underground bulb of the seedless variety. The larger specimens do not keep very well. These onions furnish the early green onions of the market known as peelers or bunchers.

Onions should be stored in a dry, well ventilated place; on foggy days

all windows should be closed. They should not be piled too close together as they are liable to sweat, grow and rot. A temperature of 32° to 40° F. offers the best protection. Curing in the sun for several days is advisable before storaging the onions in a cellar. Plants closely allied to the onion are chives, garlic, leek, shallot and Welsh onion. Onion powder is now being manufactured. It is a white product, and is finding numerous uses in flavoring sauces, condiments and soups.

ORANGE BLOSSOMS:

These blossoms are used chiefly for the manufacture of neroli and in the preparation of many puddings, icings and other desserts, the blossoms being crushed first to bring out flavor.

Orange flower water is the fragrant liquid left after distillation of the neroli. It is used in making syrups, perfumes, and at one time was used quite extensively in the manufacture of various desserts.

PARSLEY:

This is a kitchen herb used for garnishing, flavoring, and the preparation of parsley oil (a mild stimulant). Parsley grows in Sardinia, southern Europe, but is easily grown anywhere. A concentrated solution of the herb forms a viscous liquid, somewhat resembling pectin.

Hamburg parsley, or turnip rooted parsley, is a variety of common parsley grown for its white root which looks like a small parsnip, and is used in the same way.

PARSNIP:

This is a fleshy root vegetable, white in color, of a peculiar pleasing flavor, grown wild in Europe and Asia. It is rich in sugar, starch, and vitamin content, and lends itself to making a pleasant sauce with mustard, vinegar and a small amount of salt. Dug roots should be kept stored in sand or moss, in a cool moist cellar or similar place, protected from light and air, otherwise they become spongy and overtough.

PETSAI: (Chinese Cabbage or Celery Cabbage)

A salad vegetable popular in China, which has come to America. It resembles lettuce in appearance. The inner leaves are crisp and delicate; it is excellent as a salad (like lettuce) and is tender when used as boiled vegetable.

PEPPER:

The black and white powdered peppers used as condiments consist of the ground dried fruits of Piper nigrum. The perennial is a climbing

shrub native to the forests of western and southern India. For centuries it has also been cultivated on the Malay Peninsula and the adjacent islands of Sumatra, Java, Ceylon and Siam, as well as, to a limited extent, Borneo and various other tropical countries. The fruit is a small round berry, the peppercorn, growing in loosely packed clusters of twenty to thirty berries, closely attached to a common fruit stalk. Pieces of the stalk may often be found in whole black peppercorns and examination will show the depressions formed where the berries were attached. The shrub or vine grows to a height of eight to twelve feet and is supported either by poles or trees.

BLACK PEPPER:

This variety consists of the whole immature berries, gathered as soon as one or two on the clusters commence to turn red. It is then dried in the sun or near a mild fire, the outer fleshy portion of the berry shrivelling in the process, turning brown or black and becoming hard, brittle and adherent to the stony inner portion, thus forming a hardened wrinkled cortex. The Dutch East Indies are the main source of supply, with the British Straits Settlement and India next in importance. The principal commercial classifications are Malabar, Singapore, Penang, Trang, Acheen and Lampong. Others, of less importance include Japan and Siam. As a general rule, the heavier the peppercorns, the better the grade. They should be firm and round, clean and uniform in appearance and very furrowed.

WHITE PEPPER:

This is made by grinding peppercorns, after removal of their dark outer shells, either ripe or immature berries being used. The variety is less pungent but has more flavor than black pepper. It is manufactured on the pepper plantation or by merchants who buy peppercorns in the open market.

Decorticated white pepper is the peppercorn from which the seed coats have been partly or entirely removed. There are several qualities classified according to the length to which the process is carried. The most expensive variety consists of smooth, hard, pearly kernels, which have been freed from the entire seed coat. The classification of white pepper is similar to that of black pepper: Singapore, Penang, Tellicherry, Siam and other varieties. Coriander white pepper is a product of especially attractive appearance, which has been screened to uniform size and then bleached.

LONG PEPPER:

This is the dried immature fruit spike of a plant of a different species (P. longum), native to the hottest parts of India, Ceylon and Malaysia. The spikes are about 1½ inches in length and ¼ of an inch or so in diameter and have a central stem covered with closely packed, very small round berries, the whole plant being hardened. The product is crudely prepared and, generally, includes a large amount of dirt and other extraneous matter. It does not possess the fine flavor or strength of true pepper and is sometimes used to adulterate either whole or ground pepper. Its principal use is for pickles.

RED PEPPER:

Ordinary red pepper is the powdered ripe pod, both flesh and seeds or the flesh alone, of any variety of the capsicum species which gives the edible fresh pepper. It bears no relation to the true pepper plant. The capsicums constitute a native American genus and were unknown to the Old World until after Columbus's voyage to America. Supplementing the use of red pepper as a condiment is its employment in such products as gingersnaps, ginger ale, and similar products, to enhance their pungency.

CAYENNE PEPPER:

This variety is distinguished from red pepper by the fact that it is obtained only from small fruited capsicums. They are small narrow red pods, straight or curved, and from ½ to 1½ inches in length. Many varieties are now cultivated in tropical and sub-tropical countries, including our southern states, but are known chiefly as chilies.

Cayenne pepper is made by two different methods: (1) by drying the pods and then grinding them to a fine powder; or (2) by leavening with yeast the finely ground pepper (which has first been mixed with flour), shaping into small cakes and baking hard, and then grinding and sifting the product. It should ordinarily have a dull red color. The best known qualities of general importance are the East African, Zanzibar, Mombassa, Sierra Leone and Jampan; the last named variety is less pungent than the others. Nepal pepper, from a capsicum grown in India, is a good, choice variety, yellowish-red in color, very pungent and has an excellent flavor.

Cayenne is a powerful stimulant. It produces warmth in the stomach, and, in small amounts, aids digestion.

PAPRIKA:

This variety is the product of Hungarian and Spanish varieties of large red peppers, and is also known as sweet cayenne pepper, Hungarian pepper, pimiento or pimento. It is an aromatic red pepper, produced by drying and grinding special varieties of capsicums. The two distinctive types are Hungarian paprika, or Hungarian pepper, obtained from the medium large, thick, walled, dark to bright red, conical Hungarian capsicum, which is pungent and markedly sweet and aromatic. The Spanish paprika, or pimiento, etc., is made from the more rounded Spanish capsicum, which is still sweeter, agreeably aromatic, very high in color, but lacking in pungency. Hungarian paprika is employed for flavoring many dishes, while the Spanish variety is serviceable as a coloring agent for sauces, soups, baking, etc. The flavor, pungency and sweetness of the many varieties of paprika depend a great deal upon geographical derivation of the plant. The color depends upon the amount of flesh, seed and seed tissue used, and also upon the grinding process. In general, mild flavor and fine reddish color are the desirable qualities looked for. "Rosen" paprika is fine Hungarian paprika.

TABASCO:

Tabasco is a long-podded red pepper cultivated chiefly in southern Louisiana. In commerce it is best known in the form of tabasco pepper sauce, which is a rich red, concentrated extract, generally put up in very small bottles or sold in powdered form. Tabasco sauce is excellent for flavoring soups, salads and tomato preparations, although small quantities should be used, as it is very strong. A mixture of olive oil, salt, vinegar and a small amount of tabasco sauce will result in a product, which is soft and delicate but has the characteristic tabasco flavor.

PEPPERS (VEGETABLE):

These peppers are the fresh, cultivated, large-fruited varieties of capsicum, which can be consumed in the ripe, fresh, canned or dried state. They are mild in flavor, and finely colored Spanish paprika type. All varieties are used for the commercial manufacture of condiments, sauces, pickling, stuffing olives, etc. They are added to soups and catsups, for both color and flavor.

CAPSICUM:

There are numerous varieties of two or more species of capiscum, which is a bushy, branched plant, grown in nearly every part of the world. The small fruited varieties are usually the most pungent, and

are popularly known as "chilies." The variety characterized by larger fruit, is commonly known as "pepper." Chilies are made into cayenne pepper and used whole in pickles and vinegar, while "peppers" are eaten as a vegetable and ground into ordinary red pepper and paprika. The pungency of the capsicum is rooted in the tissues enclosing the seeds, but is also to be found, in a lesser degree in other parts of the fruit.

PEPPERCORN:

The peppercorn is the whole berry of the pepper plant.

PIMENTO:

This is the dried aromatic berry of the pimento tree, popularly known in this country as allspice. The tree is native to the West Indies, Mexico and South America.

PIMIENTO: (or pimento, pimienta)

This is a large-fruited, Spanish capsicum, used as a vegetable.

POPPY SEEDS:

The seeds, containing about 50% oil, are derived from an herbaceous plant sprinkled with bristly hairs. They have a white milky juice and, when bruised, give off a disagreeable narcotic odor.

Dutch poppy seeds are imported from Holland, are deep blue in color and are considered to be the best quality. Other sources of supply are Russia, India, and Turkey, the last variety being almost white in color. The seeds are used extensively by bakers, for sprinkling on rolls and as a cake filling, when ground up with sugar, honey and flavoring. The oil pressed from the seeds is pale yellow, almost odorless, of a pleasing flavor and used as a table dressing; inferior grades of the oil are utilized for soap making.

RHUBARB: (or Pie Plant)

The rhubarb is a strong perennial plant, grown for its thick, succulent, acid leaf stalks, which serve as an excellent fruit for use in sauces and pies. Drying in the sun, and then soaking in water, revives the wilted stalk. Rhubarb leaves should never be eaten, their oxalic acid content being sufficiently high to be dangerous for those with sensitive kidneys. The plant is used on a very small scale in the manufacture of rhubarb juice, which must be sweetened with sugar. The treatment consists of removing the oxalates and oxalic acid, pressing, concentrating and sweetening the juice.

ROSELLE: (or red sorrel, Jamaica sorrel)

This is an annual bushy plant, whose seed pods make excellent jellies, resembling cranberries in flavor and appearance. The pods are boiled until soft, strained, sugar added, thus proceeding in the same manner as in the manufacture of any other jelly. The fleshy part surrounding the seed pods can also be made into a jam or syrup or used in pies. The plant is native to Australia, and has recently been introduced in this country.

ROSEMARY:

Rosemary is a hardy evergreen plant or shrub, native to southern Europe and Asia Minor, whose leaves are very fragrant and stimulating. The leaves are sometimes employed in seasoning and flavoring preserves, but its principal use is in perfumery.

SAFFLOWER SEED:

This is a product of a thistle-like herb, with orange-red head, grown in the United States, and employed in dyeing as a substitute for saffron.

SAFFRON:

Spain is the most important source of supply of saffron, the highly colored, dried, orange-red stigmas and styles of a purple variety of crocus. It is frequently adulterated with tumeric or safflower seed. Saffron is used principally in perfumes, for tinting confectionery, and as a general culinary ingredient. There are restrictions for its use in foods in this country.

SAGE:

Sage is a shrubby plant, whose dried, whitish-green leaves are used for flavoring soups, sauces, cheeses, sausages, poultry, pork, etc., because of its aromatic, bitter and slightly astringent flavor. It is cultivated in Greece and Dalmatia, the latter variety being the better; the Greek variety has a stronger odor but is inferior in taste to the Dalmatian.

SARSAPARILLA:

The sarsaparilla extract is made from the long, thin, dark brown, and bitter flavored rootstocks of several species of tropical smilax. In using the plant in beverages, its natural bitterness is modified by the addition of oil of wintergreen, sugar, vanillin and other flavors.

SMILAX:

This is a genus containing about 225 species, mostly herbs and wood climbing trailing plants, some of which yield sarsaparilla.

SASSAFRAS:

This is the spicy bark of the trunk and root of the sassafras tree, employed to make sassafras tea, and cultivated largely along the Atlantic coast and in other parts of the United States. The twigs, leaves, and leaf buds of the sassafras tree have long been used for their flavor, and are now extensively used in the manufacture of beverages and confectionery.

SAVORY:

Savory is an annual herb, erect in character, with a strong, agreeable aromatic smell and flavor. Its smooth leaves are in common use, both fresh and dried, for flavoring soups, sausages, sauces and dressings. Dried savory is sold in cans and bottles. The plant is a native of the Mediterranean countries.

SLOE: (or Blackthorn)

This is a thorny shrub of the plum group, whose fruit is nearly round in shape, about the size of a very large pea, sour and astringent in flavor, and used as a flavoring for various liquors, especially in sloe gin.

TAMARIND:

The tamarind is the fruit of an East African tree (which reaches a height of 80 feet). It consists of thin brown shell pods, filled with an acrid, sweet, brownish pulp, and containing acetic, citric and tartaric acids, potassium and other salts, and from one to twelve, large, flat, hard, glossy seeds. Pulp and seeds are transferred to kegs, covered with boiling syrup, and shipped to foreign markets. Sugared tamarinds are packed in alternate layers of sugar and fruit, thus retaining much of the original color and flavor.

Tamarind pulp serves as an excellent addition to chutneys, curries, sauces, and, when considerably diluted with sugar water, makes a nice beverage.

TARRAGON: (Estragon)

Tarragon is a perennial aromatic herb used for flavoring vinegar, mustard, pickles, sauces and salads. It is grown in Siberia and Europe, and now also in America. The leaf of the tarragon plant is sold green or

dried, and half a pound of green tarragon will flavor fifty or more gallons of tarragon vinegar.

THYME:

Thyme, a native of the Mediterranean region and a member of the mint family, is cultivated for its fragrant tops and leaves which are popular for seasoning. The best variety of thyme is the lemon scented. For drying purposes, the thyme should be cut just before it starts to blossom. Commercial thyme comes in powdered form, and is used in dressings and fillings.

TONKA: (or Tonqua, Bean, or Coumara Nut)

Tonka is the dark aromatic seed of a tall South American tree, formed singly in a thick pod. The essential principle is coumarin, a white crystalline powder found under the coat and between the lobes. Because of similarity in aroma, the extracted coumarin is used to bolster up flavor in imitation vanilla extracts. The Dutch tonka bean, or angostura, is about 1½ inches long and has a brown inside, whereas the Para, or English, tonka bean is a small seed, with a white inside and very few white courmarin crystals.

TURMERIC (CURCUMA):

Turmeric is the aromatic rootstock of a southern Asiatic plant, sold both in root and powder form. The dried root varies from a dark orange to a deep reddish-brown, but in powdered form appears yellow. The central portion of the root of the curcuma or turmeric plant is tuberous, sending out nearly cylindrical branches, some of which become thickened at their ends, and which contain a pure starch. The principal commercial varieties are Chinese, Bengal, Madras, Java and Cochin turmeric.

Turmeric is the principal ingredient of curry powders and is also used in mustard and other spices. Its pigment is marketed as curcuma oil and curcumin and is employed as a dyestuff. Its use as a coloring material in foodstuffs is somewhat restricted by the pure food laws.

VANILLA BEANS:

The fruit of an orchid, a parasitic climbing plant found in most tropical countries, but is indigenous to Eastern Mexico. The vanilla plant has been introduced into some of the West Indian Islands, into Bourbon, Madagascar, and several East Indian Islands. In its native country it is probably fertilized through the agency of insects, in other countries artificial fertilization is required. The vanilla bean is from 6

to 10 inches long and about ½ inch thick. The beans are gathered when they become slightly hard and begin to turn yellow at the lowest end. It requires long experience to determine the proper stage for harvesting the beans. If the pod is too green when picked the flavor is inferior when it is cured; if too ripe it splits while curing, losing some of its flavor. The flavor is developed in the curing process, of which there are two methods:

The Mexican or sun process and the Bourbon or hot water process.

4½-5 pounds of the green beans are required to produce 1 pound of the cured bean.

The various kinds of Vanilla Beans are known as:

Mexican Beans	Quality A—9″ long. Roughish to the touch Quality B—7¾″-8″ long. Dark brown
Porto Rican Beans	
South American Beans	
Bourbon Beans	7″ long. Not as firm as Mexican
Madagascar Beans	Almost black
Java Beans	
Tahiti Beans	6″ long. Reddish brown

listed in quality in the order named.

Vanilla beans from which the vanillin has been removed by means of a solvent are sometimes offered to the trade.

The fraud is to be detected by the weakness of the flavor and odor. Such beans are sometimes improved in appearance and in odor by the use of benzoic acid.

Place some of the crystals (as a rule they are flattened and rhomboidal and lie upon the bean; those of vanillin are usually needle shaped and stand out almost at right angles from the surface of the fruit) in a test tube. Heat over a Bunsen burner, and if composed of benzoic acid the irritating odor of this acid may be detected.

PERCENTAGES OF VANILLIN

(Busse)

	Per Cent
Mexican Vanilla Bean	1.69–1.86
Bourbon Vanilla Bean	1.91–2.48
Java Vanilla Bean	2.75
Tahiti Vanilla Bean	2.0

The practical value of a vanilla bean is not by any means to be determined by the percent of vanillin content, since it frequently occurs that the very finest beans will show the smallest vanillin content.

PERCENTAGE OF RESIN
(Brooks)

	Per Cent
Mexican Vanilla Bean (whole)	1.47
Mexican Vanilla Bean (cuts)	1.96
Bourbon Vanilla Bean	1.93
Comoros Vanilla Bean	1.96
Mexican and South American Vanilla Bean	2.56

TRUE VANILLA BEAN AND IMITATION VANILLIN

About 1858, it was definitely established that the fine, tiny white crystals found on vanilla beans, regarded by many as the criterion of quality, was in fact, the aromatic principle of the bean itself. This crystalline substance, the chemical constitution of which was unknown at that time, was given the name vanillin. Ordinary vanillin always refers to methyl vanillin, which is the natural vanillin present in the vanilla bean, as described above. Today we have a stronger competitive flavor in ethyl vanillin. The choice between the two varieties depends on the manner in which it is prepared and the use to which it is put.

Natural vanillin is found in a wide variety of common plant substances, e.g., sugar beets, asparagus, cloves, benzoin, balsam and asafetida. However, the amount of vanillin found naturally in these products is so small, that it does not pay to process them for vanillin. For many years chemists have been trying to synthesize vanillin from its component elements. The first successful synthesis of vanillin was carried out using "coniferin," a resin obtained from the bark of pine trees. This method of production was used until vanillin was discovered to be an aldehyde of vanillic acid (methyl protocatechuio aldehyde). Sometime later, guaiacol, or methyl catechol, was discovered in the tar of the beechwood tree. This proved to be another step forward in indicating a production method of vanillin from guaiacol of aniline origin. This new source provided sufficient raw material to take care of almost all the major requirements for artificial vanillin; by the simple addition of oxygen to Eugenol, oil of cloves, is transformed to crude vanillin.

Today a large amount of vanillin is manufactured from clove oil. Two pounds of clove oil are required to make one pound of vanillin (about

6 pounds of the clove spice are required to make one pound of oil). In England, the manufacturers use clove oil as the starting point in vanillin manufacture and, although the majority of European plants employ the so called guaiacol or coal-tar process, it is safe to assume that most of the vanillin is manufactured from clove oil, with only a small quantity coming from guaiacol.

Since vanillin is a definite chemical compound, it will always have the same flavor and aroma, if extreme care is taken in manufacturing and refinement. Therefore, vanillins produced from eugenol or guaiacol should compare favorably.

Briefly, vanillin is produced by first distilling over the oil from the clove spice. The oil passes over with the steam condensate and is separated from the water. The clove oil so obtained is largely composed of eugenol. The eugenol is then separated from the clove oil and treated with caustic soda under pressure; it is then acetylated with acetic anhydride, and the acetylation product oxidized to crude vanillin. Numerous other methods have been advanced for the manufacture of vanillin from eugenol.

One pound of vanillin roughly approximates the flavoring value of 30 pounds of the best vanilla bean.

ETHYL VANILLIN:

The ethyl ester of protocatechuic aldehyde is known rather erroneously as ethyl vanillin and is also known commercially as Bourbonal, Ethovan, Vanillal, and Vanirome. With respect to intensity of taste and odor, this compound is about 3 to 4 times as strong as vanillin. Ethyl vanillin melts at approximately 40° C. (lower than regular vanillin), but the two compounds are chemically quite similar.

Ethyl vanillin consists of colorless flakes, sparingly soluble in water, but soluble in alcohol and ether.

WINTERGREEN:

Wintergreen is a small evergreen herb, used primarily for extraction of its oil, and growing wild in many parts of the United States. It is also known as oil of Gaultheria and is used to flavor confectionery and soft drink beverages. The principal present source of so-called "natural wintergreen oil" is the sweet, or black, birch, Betula lenta, the twigs and leaves of which yield oil of Betula, chemically identical with wintergreen.

ROOTS, BARKS, HERBS, LEAVES, STEMS, SEEDS, FLOWERS

I. Very Strong, Bitter

Common Centaury (Latin—Herba Centaurii)
Taste: Very strong, bitter
Use: For bitters and liquors

Wormwood (Latin—Herba Absinthii)
Taste: Strong, bitter and aromatic
Use: For "absinthe" and for bitters

II. Strong, Bitter

Holy Thistle (Latin—Herba Cardui Benedicti)
Taste: Strong, bitter and lasting bitter
Use: For bitters

Cinchona Bark (Latin—Cortex Chinae)
Taste: Very bitter and astringent
Use: For bitters

Gentian Root (Latin—Radix Gentianae)
Taste: First sweet, then strongly bitter
Use: For "Enzianschnaps"

Quassia Wood (Latin—Lignum Quassiae Surinamense)
Taste: Not as bitter as Gentian
Use: For bitters

III. Aromatic, Bitter

Inule Root (Latin—Radices Inulae)
Taste: Bitter, peculiarly spicy
Use: For bitters

Angelica Seeds (Latin—Semina Angelicae)
Taste: Sharp, bitter
Use: For bitters

Angelica Root (Latin—Radix Angelicae)
Taste: Strongly spicy, not as bitter as the seeds
Use: For bitters, especially for "Chartreuse"

Valerian Root (Latin—Radix Valerianae)
Taste: Sweet, spicy, somewhat bitter
Use: For bitters

Sweet Calamus (Latin—Rhizoma Calami)
Taste: Spicy and bitter
Use: For aromatic liquors

Lemon Peel (Latin—Cortex Citri)
  Taste: Spicy, slightly bitter
  Use: Chartreuse, Curacao

Coriander (Latin—Fructus Coriandri)
  Taste: Sweet, strong, spicy, then burning sensation
  Use: For liquors. Spice

Cubebs (Latin—Fructus Cubebae)
  Taste: Spicy and bitter, not burning
  Use: For liquors. Spice for "Ulmer Pfefferkuchen"

Fenouil Batard (Latin—Fructus Anethi)
  Taste: Spicy like Dill and Caraway, slightly bitter
  Use: For hard liquors

Roman Chamomile Flowers (Latin—Flores Chamomillae Romanae)
  Taste: Bitter, spicy
  Use: In small quantities for liquors

Curled Mint (Latin—Herba Menthae Crispae)
  Taste: Spicy, slightly bitter, but not cooling
  Use: For liquors

Caraway (Latin—Fructus Carvi)
  Taste: Strong aromatic, slightly bitter
  Use: For "Kummel." Spice

Lovage Root (Latin—Radix Levistici)
  Taste: Strong spice; first sweet, then bitter
  Use: For stomach bitters and liquors

Laurel Leaves (Latin—Folia Lauri)
  Taste: Aromatic; spicy, but bitter
  Use: For liquors. Spice

Marjoram (Latin—Herba Majoranae)
  Taste: Spicy and bitter
  Use: For liquors. Spice

Clarysage (Latin—Salvia Slarea)
  Taste: Spicy, bitter
  Use: For liquors. Substitute for hops

Myrrh (Latin—Gummi Resina Myrrha)
  Taste: Astringent, bitter
  Use: For tinctures

Orange Flowers (Latin—Flores Aurantii)
  Taste: Pleasant aromatic, slightly bitter
  Use: For liquors

Beautressel (Latin—Herba Saturejae)
Taste: Strong, bitter
Use: Rarely for liquors. Called "Pfefferkraut"

Peppermint (Latin—Folia Menthae Piperitae)
Taste: Burning cool, slightly bitter and strong spice
Use: For liquors. Spice

Rosemary Flowers (Latin—Flores Rosemarini)
Taste: Mild spice taste, very slightly bitter
Use: For liquors

Sage Leaves (Latin—Folia Salviae)
Taste: Powerful, spicy and bitter
Use: For liquors. Spice

Thyme (Latin—Herba Thymi)
Taste: Pleasantly spicy, but bitter
Use: For liquors. Spice

Juniper Berries (Latin—Fructus Juniperi)
Taste: Strong, spicy and bitter
Use: Genever and Gin

Levant Wormseed (Latin—Flores Cinae)
Taste: Peculiar bitter and cooling
Use: Rarely for stomach bitters

Ginger (Latin—Rhizoma Zedoariae)
Taste: Like camphor, bitter and spicy
Use: For stomach bitters

Angostura Bark (Latin—Cortex Angosturae)
Taste: Pleasantly spicy, but very bitter
Use: For Angostura type bitters

Curacao Peel (Latin—Cortex Curacao)
Taste: Bitter but different from orange
Use: For Curacao and Benedictine

Iva Musk (Latin—Herba Ivae Moschatae)
Taste: Spicy, but bitter and lasting
Use: Iva liquor

Orange Peel (Latin—Fructus Aurantii Immaturi)
Taste: Strong, bitter
Use: Bitters

Bitter Orange Peel (Latin—Cortex Aurantii Fructus)
Taste: Fruity, bitter
Use: Abtei Liquors

Rhubarb Root (Latin—Rhizoma Rhei)
Taste: Aromatic bitter
Use: Stomach bitters

IV. Mild Aromatic without Bitter Taste

Arnica Flowers (Latin—Flores Arnicae)
Taste: Strong astringent and weak bitter
Use: In small quantities for bitters and liquors (contains a poison: Arnicin)

Elder Flowers (Latin—Flores Sambuci)
Taste: Sweet, then scratching
Use: Liquor and tobacco aroma

Guaiacum Wood (Latin—Lignum Guajaci)
Taste: Sharp and scratching, not bitter, rather sweet
Use: Strong liquors

Cacao Beans (Latin—Semen Cacao)
Taste: Pleasant, spicy, nut-like taste, very slightly bitter
Use: For liquor

Lavender Flowers (Latin—Flores Lavandulae)
Taste: Strong, spicy, not bitter
Use: For liquor

Linden Flowers (Latin—Flores Tiliae)
Taste: Pleasantly aromatic, slimy
Use: For some liquors

Beunet Root (Latin—Radix Caryophyllatae)
Taste: First bitter, then sweet, later astringent
Use: Heavy liquors

Parsley (Latin—Herba Petroselini Foliorum)
Taste: Strong, spicy
Use: Liquor. Spice

Celery Seeds (Latin—Semen Apii Graveolentis)
Taste: Like celery
Use: Spice extracts. Spice

Celery Root (Latin—Rhizoma Apii Graveolentis)
Taste: Strong, spicy, slightly burning
Use: Liquors. Spice

Orris Root (Latin—Rhizoma Iridis)
Taste: Pleasantly aromatic, but slightly irritating
Use: Liquors

Hyssop (Latin—Herba Hyssopi)
  Taste: Pleasant, spicy, slightly like camphor, slightly bitter
  Use: Liquors

V. Aromatic with Burning Taste

Pyrethrum Root (Latin—Radix Pyrethri)
  Taste: Burning, sharp, astringent
  Use: For strong tasting liquors

Galanga Root (Latin—Rhizoma Galangae)
  Taste: Pleasantly spicy, but sharp
  Use: Strong bitters

VI. Aromatic with Sweet Taste

Sweet Orange Peel (Latin—Cortex Aurantii Dulcis)
  Taste: Pleasantly sweet, refreshing
  Use: Liquors

John's Bread (Latin—Fructus Ceratoniae or Siliqua Dulcis)
  Taste: Very slimy, but very sweet
  Use: For Rum, Cognac

Manne (Latin—Manna)
  Taste: Very sweet, afterwards irritating
  Use: Liquors

Liquorice Root (Latin—Radix Liquiritiae)
  Taste: Peculiarly sweet, but slightly bitter
  Use: Liquors

VII. Aromatic with Vanilla Taste

Melilot (Latin—Herba Meliloti)
  Taste: Slimy, sharp and bitter
  Use: Tobacco essence

Tonka Beans (Latin—Fabae Tonco)
  Taste: Strong slimy, sharp and bitter
  Use: Tobacco, Waldmeister, bitters, liquors

Vanilla (Latin—Fructus Vanillae)
  Taste: Pleasantly aromatic, bitter-sweet
  Use: Liquor. Essences
  Remarks: Contents of Vanillin
    Mexican-Beans: 1.3 –1.8%
    Bourbon-Beans: 0.75–2.9%
    Java-Beans: 1.5 –2.7%

Wood-ruff (Waldmeister) (Latin—Herba Matrisilvae or Asperulae Odorata)

Taste:	Bitter, like Coumarin
Use:	Waldmeister essence, Tobacco flavor

VIII. Aromatic with Tannin

Limousin Bark (Latin—Cortex Quercus Ilex)

Taste:	Strong bitter, astringent
Use:	Cognac. For aging Whiskey, Cognac, etc.

TRUE SPICES:

Allspice	Cloves
Cardamom	Mace
Cinnamon	Nutmeg
Cinnamon flowers	Vanilla Bean

AROMATICS WITH SWEET TASTE:

Anise	Fennel
Star anise	Liquorice root
Carob	Manna
Coriander	Sweet orange peel

AROMATICS WITH SPECIFIC TASTE:

Bitter almond (poisonous)	Bitter taste.
Apricot kernels	Bitter taste.
Common laurel leaves	Bitter taste.
Vanilla beans	Aromatic taste.
Tonka bean	Courmarin taste.
Woodruff	Courmarin taste.
Oak bark	Tannic acid taste.
Tannic bark	Tannic acid taste.

COLORING MATTERS:

Alkanet root	Red	Mallou flowers	Red
Buckthorn berry	Yellow	Raspberry black	Red, purple
Catechu	Brown	Saffron	Yellow
Cochineal	Red	Sandal wood	Red
Cudhear	Yellow	Yellow wood	Yellow
Curcuma root	Yellow	Turmeric	Yellow
Huckelberry black	Red	Pimento	Red
Kino	Red	Raspberry (Colombia)	Purple

GUMS

The natural gums may be subdivided into two classes: (1) gums which are "soluble" in water, forming a thick, viscous, sticky solution, which can be filtered, and (2) gums which do not dissolve, but swell with water to form heavy, viscous liquids, and which cannot be filtered. The natural gums are vegetable products which occur as amorphous, translucent or transparent exudations from plants, leaves, etc. The gums may be dissolved out with the aid of alkalies, but upon addition of alcohol, all gums are precipitated or thrown out of solution. Gums differ from starch or cellulose by being soluble or swelling in water; they differ from sugars by being incapable of alcoholic fermentation with yeast. Three important ingredients found in gums are:

a. Arabin or arabic acid (the soluble form as found in gum arabic).
b. Bassorin or insoluble gum (found in gum tragacanth).
c. Cerasin (insoluble, found in cherry gum).

GUM ACACIA OR ARABIC:

This valuable gum consists mainly of arabic acid, or arabin, combined with lime, potassium or magnesium. It is bleached by exposure to the sun, and comes both in powdered and lump form. The gum is an exudation from the acacia and mimosa species found as low shrubs in Africa and the Orient. The gum is used extensively for the suspension of insoluble substances in water, especially flavoring oils. The granulated gum dissolves more readily in water than the finely powdered product. Its easy solubility and the absence of the tendency to form lumps, makes the coarse powder preferable for solutions, emulsions, etc. Acacia is also used as a binding agent in tablets and pills.

CARRAGHEEN OR IRISH MOSS:

The mucilaginous constituent of Irish moss is carragheen. It is not precipitated out with alcohol, and in this respect, differs from gum or starch. Another name for Irish moss is chondrus, the dried plant of an alga that grows in the Atlantic Ocean. It is used as an emulsifying agent for cod liver oil and also to make jellies for sick patients, one part being sufficient to combine with sixty parts of slightly sweetened water. Carragheen can now be obtained in a highly purified state, capable of combining with even more water, and free from the peculiar taste which is so characteristic of Irish moss.

BASSORIN:

Bassorin is the insoluble gum portion found in tragacanth, and is precipitated out of solution by means of alcohol, as in the separation of arabic acid from gum acacia.

GUM KARAYA OR INDIAN GUM:

This is a very useful gum, its color varying from a light pink to greyish-white, very cheap in price, and shipped from Bombay.

GUM TRAGACANTH:

There are many species yielding tragacanth, all being low shrubs growing in the country between eastern Persia and Greece. It consists of about 33% bassorin (insoluble gum), 53% soluble gum, 11% water and 3% impurities. In water tragacanth absorbs a certain amount, then swells very much to form a soft adhesive paste, but does not dissolve. If additional water is added, the paste forms a uniform solution, but in the course of one or two days, the greater part of the gum separates out, leaving a small amount dissolved in the supernatant liquid. There are numerous starch grains present in gum tragacanth. Tragacanth of varying colors is sold in leaf form. Common tragacanth consists of pear-shaped pieces of brownish color.

BRITISH GUM OR ARTIFICIAL GUM:

Starch, when acted upon by dilute acids, diastase or heat, is converted to dextrin, a substance resembling gum in appearance and properties. Dextrin is soluble in hot or cold water, and forms a mucilaginous solution, from which it is precipitated by alcohol. The product, found on the market, is sold as British or artificial gum.

British gum is sold in the form of a brilliant white powder or in small masses or fragments resembling natural gum. It may be distinguished from gum arabic by the taste and the peculiar harsh sensation when rubbed in the hand.

SOLUBILITY OF GUMS AND THICKENING AGENTS IN WATER:

Gum arabic is very soluble in hot or cold water. It should, therefore, be added to the water and stirred at the same time. In making concentrated solutions, the best method is to pack a linen bag with the gum and immerse it in the water.

Agar-agar, a purified sea weed, dissolves very slowly in cold water, rapidly in hot. On cooling, it forms a gel or stiff jelly. If the agar-agar is heated with acids, it breaks down forming a correspondingly weaker gel on cooling.

British gum (dextrin) is easily soluble in water and does not form a gel on cooling.

Gum karaya (Indian gum) is sparingly soluble in either hot or cold water. The particles swell, forming a heavy, stringy, sticky liquid. It is used in emulsifying oils and in suspending solids in solution.

Irish moss (carragheen) is a seaweed, sparingly soluble in water, which forms a translucent, viscous, yellowish solution. It has a great affinity for water, emulsifies oils, and suspends solids in solution.

Locust bean kernel gum powder is derived from St. John's Bread. It is sparingly soluble in water, swells considerably, forming an opaque colloidal solution from which a precipitate settles out on standing. It has great affinity for water; and is used in any number of ways to stabilize fruit juices from running out of pies and bakery goods.

Pectin, a carbohydrate found in fruits such as the apple, lemon and orange, is available in powder form and used extensively in making jellies. It is easily dispersible in hot or cold water and will form a jelly only when the sugar, acid and pectin are present in correct ratio to each other. Pectin is used for thickening chocolate syrups and many other products.

Quince seed, derived by cooking the fruit in water, forms an opalescent solution, stringy, sticky and very useful for thickening water or sugar solutions.

Sodium alginate and ammonium alginate (products manufactured from sea kelp or alginic acid) are readily soluble in cold or hot water when properly prepared. Adding the product slowly and mixing in at same time is a good way of preparing a solution. The solution is pale straw color, translucent, viscous and readily precipitated by acid or mineral salts, forming alginic acid or metal alginates respectively. The salts are used extensively as conditioners in ice cream mixes, and for suspending solids in liquids.

Defatted soy bean flour has a great affinity for water and is, therefore, a good addition to products treated with water which may have a tendency towards weeping out.

"Gomagel" a new proprietary gum is a white powder which gives viscous water gels and jellies. This is used as a substitute for agar, gelatin and tragacanth in certain cases.

TABLE OF EDIBLE FATS AND OILS

Almond oil	Palm kernel oil
Cocoa butter	Peanut oil
Cochin oil	Poppyseed oil
Ceylon oil	Rapeseed oil
Corn oil	Soybean oil
Cocoanut oil	Sesame oil
Cottonseed oil	Sunflower oil
Olive oil	Teaseed oil

Fats and oils have complex structures and are compounds of glycerin and various fatty acids. The oils, when subjected for a long time to the action of light and air, develop a distinctly rancid odor and taste.

Oils and fats that are liquid at ordinary temperatures consist mostly of oleic acid; olive oil is an example. Stearic and palmitic acids are predominant in those fats that are solid at room temperature; beef and mutton tallow are good examples.

PROPERTIES OF OILS

Name of Oil	Iodine Value	Specific Gravity at 15° C.	Acidity (Based on oleic acid)
Almond	93–104	0.9175–0.9195	5.8
Apricot Kernel	101–108.7	0.9172–0.9200	
Corn (Maize)	113–129	0.9213–0.9268	1.4
Cottonseed	104–115	0.915 –0.930	0.0–3
Lard	65– 80	0.913 –0.919	
Linseed	171–201	0.925 –0.938	
Olive	77.5– 91	0.914 –0.918	0.3–5
Peach Kernel	93–109	0.918 –0.9215	
Peanut	85–103	0.9110–0.9220	0.8–4
Rape	102.1–106.8	0.9132–0.918	0.5–7
Sesame	103–114	0.9210–0.9244	0.3–3
Soya Bean	121–139	0.9194–0.9290	
Cocoanut	6.2– 10	0.926	

PROPERTIES OF FATS

Name of Fat	Solidifying Point Degrees C.	Name of Fat	Solidifying Point Degrees C.
Beef Marrow	29–31	Goose Fat (Wild)	18–20
Beef Tallow	27–38	Harefat	17–23
Beeswax	60.5–62.8	Horsefat	20–45
Bonefat	15–17	Human Fat	15
Butterfat	20–23	Lard	27.1–29.9
Chickenfat	21–27	Mutton Tallow	32–41
Cocoabutter	21.5–23	Rabbit Fat (Tame)	22–24
Cottonseed Stearin	16–22	Rabbit Fat (Wild)	17–22
Dog Fat	20–26	Vegetable Tallow (Chinese)	27–35
Egg Fat	....	Wool Fat, Purified	38–40
Goose Fat (Domestic)	18–20		

THE UNITED STATES GOVERNMENT LISTS AS EDIBLE FATS AND OILS THE FOLLOWING

Almond Oil
Cacao Butter
Cocoanut Oil
Cochin Oil
Ceylon Oil
Corn Oil
Cottonseed Oil
Olive Oil
Palm Kernel Oil
Peanut Oil
Poppyseed Oil
Rapeseed Oil
Soybean Oil
Sesame Oil
Sunflower Oil
Teaseed Oil

OLIVE OIL:

Olive oil has long been a very important fat in the diet of the people of the Mediterranean countries. Large quantities of olive oil are produced in Spain, France, Italy, and of late there has been considerable production in America.

Olive oil is pressed from warm, ripe olives, which have first been ground between stones. The paste thus formed is put into closely woven baskets, which are then piled one on top of the other in a hydraulic press. Great pressure is then brought to bear upon this ground mass. The first oil that is extracted in this manner is known as "virgin" or "extra virgin" olive oil. After the oil has been allowed to run for sometime, the baskets are removed, and the pomace softened up considerably with hot water and replaced in the hydraulic press and squeezed again. This second pressing, which yields a slightly inferior grade of oil, is col-

lected; each subsequent pressings produce an oil of lower grade than that obtained from the previous pressing.

Olive oil has a pale yellow or greenish-yellow color and has a specific gravity of 0.914 to 0.918; it solidifies at 2° to 5° C. Oils containing an excessive amount of solid fats solidify at higher temperatures. Olive oil is soluble in ether, chloroform and carbon disulphide. It becomes rancid on long exposure to light. One ton of olives will yield approximately 35 to 45 gallons of oil. The residue or pomace that remains behind after extraction of the oil, is utilized for further recovery with various fat solvents such as ether, benzene, chloroform, carbon disulphide and gasoline. In European countries where olive oil is produced, the pomace is dried and then extracted with a volatile solvent. The oil so produced is refined and used for industrial purposes, e.g., soap manufacture.

COCOANUT OIL:

This oil resembles butter fat in properties and is used for making artificial butter. It is a white, semi-solid, lard-like fat which becomes liquid at 20 to 25° C. The oil is soluble in the usual solvents such as ether, chloroform, carbon disulphide, etc.

Refined cocoanut oil is a white, neutral product, with an agreeable flavor and taste, and should be stored in a cool and moisture-free compartment.

CORN OIL:

Corn oil is obtained from the germ of the Indian corn kernel. The grain is first softened by allowing it to soak in warm water, and the loosened germs are then crushed to a ground meal. The oil thus obtained is refined, producing edible corn oil. The product has a clear, yellow color, and has a specific gravity from 0.9213 to 0.9268 at 15° C. Corn oil is extensively used in the manufacture of mayonnaise and oleomargarine.

COTTONSEED OIL:

Cottonseed yields from 30 to 35% oil. The meat of the seed is pressed between heavy rollers and cooked in steam-jacketed kettles. It is then extracted in a hydraulic press using a pressure of 3 to 4000 pounds per square inch. About 85% of the oil is extracted and the balance remains behind in the oil cake. This cake is exceptionally rich in fats and proteins and is very valuable as a cattle food. The cottonseed oil, in alkaline solution, has to be refined further, with the aid of heat and agitation in large tanks. In this manner, the free fatty acids are removed, along with the resinous coloring materials. After the impurities settle out, a clear

yellow oil is drawn off, filtered through Fuller's earth and deodorized. The refined oil is known as summer yellow oil. Winter pressed oil is made by chilling the summer yellow and removing the stearin and palmitin which crystallize out. The fat is then sold as cottonseed stearin.

Cottonseed oil is soluble in ether, chloroform and carbon disulphide, is practically odorless and has a specific gravity of 0.915 to 0.930 at 15° C. It is extensively used in the manufacture of mayonnaise and lard substitutes. The yield from one ton of cottonseeds is approximately 50 pounds of oil.

PEANUT OIL:

The oil that is first pressed from the peanut is nearly colorless while that of the second pressing is usually pale greenish-yellow. Peanut oil is used as a salad oil and also in manufacturing shortening, oleomargarine and similar compounds. This specific gravity is 0.911 to 0.922 at 15° C.

SESAME OIL:

The pressed oil of the sesame is yellow and has a pleasing taste. It can be used as a salad oil and for making butter substitutes.

SOYBEAN OIL:

Pressed soybean oil is yellow, and has a pleasing taste and odor. It is used as a salad oil and the meal cake, left after expression of the oil, is a valuable cattle food. The soybean is high in oil content and contains very little starch.

HYDROGENATION OF OILS:

Hydrogenation converts liquid oils into solid fats. Thus, if olein (e.g., in cottonseed oil) reacts with hydrogen, it is converted to stearin, which is a solid. Hydrogenation is conducted under pressure, at 150° to 250° C., with hydrogen gas and a finely divided nickel or platinum catalyst. The hydrogen used must be exceptionally pure and absolutely free of hydrogen sulfide, arsenic, sulphur, etc. Oils which have peculiar odors lose them to a considerable degree during hydrogenation. The melting point of the oil varies with the degree of hydrogenation.

CEREAL FLOURS

Wheat flour, the most important cereal food, represents the vital part of bread and bakery products. It is exceptionally rich in gluten, the essential ingredient in fermented bread products.

CLASSIFICATION OF WHEAT

Selective cultivation and crossing-breeding has brought about the development of the excellent modern varieties of wheat. Climate, soil, type of seed, and time of planting determine the character of the wheat. Wheat flour and other wheat products supply 20% of the total food used in the U. S.

PRINCIPAL TYPES OF WHEAT:

The United States government classification of wheat is as follows: hard red spring, durum, hard red winter, soft red winter, white mixed wheat. Durum wheat, which possesses a high gluten content, yields a yellowish flour that is not suitable for bread making; it is used mainly for macaroni.

WINTER AND SPRING WHEAT:

Winter wheat is sown during the fall, in localities having a winter climate mild enough to permit the plant to survive.

Spring wheat is sown in the spring in those localities whose climate is too rigorous for winter wheat.

Winter wheat is harvested in the latter part of June and July, spring wheat in late July, August and September. Spring wheat, grown east of the Rocky Mountains, usually represents hard wheat. Winter wheat is classified as soft winter or hard winter.

HARD AND SOFT WHEAT:

There are many varieties of both the hard and soft, spring and winter wheat. Hard wheat is relatively hard to the touch, has a high gluten content, is strong in elasticity and quality, and is used in bread making. Soft wheat, on the other hand, is relatively soft to the touch, contains less gluten, and may be very strong or weak in quality. Its greatest use is in the baking of cakes, pastries, doughnuts, etc.

FLOUR

Milling of wheat produces various types of flours. Before the actual milling takes place, a pre-treatment of the grain is necessary (e.g., screening, scouring, washing and drying). The thoroughly clean wheat is then moistened under properly controlled temperature and moisture conditions.

Straight flour represents all the flour produced from the wheat in the milling process, after the removal of the bran and feeds. Patent flour is

highly refined flour, is very light in color, and comes from the central part of the wheat grain. Clear flour is the residue left after the patent portion has been removed. The patent and clear portions together represent the straight flour. Clear flour may also be sub-divided into first and second clears, the former being more highly refined, having better color and less ash than the latter.

Red dog shorts, the residue of the kernel (averaging from 3 to 5% of the entire grain), are used as animal feeds. Graham wheat is the entire crushed wheat berry, while whole wheat flour may, or may not, have had part of the bran removed. Blended flours are made by mixing together various grades of wheat. Farina, for example, represents the hard, crushed particles of wheat, which are known as middlings; on the other hand, gluten flour is the product resulting from washing out part or all of the starch from wheat flour. The yield of flour secured from any common wheat usually runs 70 to 76 per cent middlings (subsequently ground into flours of various grades) and 24 to 30 per cent of feed.

RYE FLOUR:

There are 3 grades of rye flour, light, middle and dark. Rye is a species of grain resembling wheat but, generally, having much taller stalks. It is a very hearty grain and will grow in cold regions and in soil that is too poor for wheat; the chief producer is Russia. However, it thrives best under conditions that are also favorable to wheat. Rye bread is made by mixing rye flour with wheat flour, known as "Bohemian rye." Rye is also used in very large quantities for the production of whisky.

CORN OR MAIZE

Term "corn" is used generally to designate all the principal grains; in this country, however, it is specifically applied to Indian corn, or maize, the seed of the most beautiful, luxuriant, and abundant of all grain grasses. It is native to tropical America, and was used as food by the Indians, centuries before the arrival of Columbus. The corn belt in America includes Iowa, Illinois, Nebraska, Indiana, Missouri, Kansas and Ohio; the other important producing countries are Hungary, Roumania, Italy, Russia, Mexico, Argentia, South Africa and Egypt.

Corn has a lower protein content than wheat and oats, but is fully equal in all other respects to the other grains and in many cases, the fat or oil content is greater. It does not produce as good a loaf of bread as wheat grain, due to its smaller gluten content.

Corn grain consists of the germ (the oily part), the endosperm (the body of the kernel, mostly starch and some gluten), and the hull, or bran.

The germ is used in the manufacture of corn oil, while the starch provides other edible manufactured products. There are many varieties of corn, e.g., flint, dent, soft, and sweet. The whole kernel minus the germ and hull constitutes the edible part of the corn and is called samp. Coarsely ground corn is called hominy. The coarsely ground product of the whole kernels, bolted to remove the bran, is known as corn meal.

RICE

The chief rice producing countries are India, China, Japan, Spain, Italy, Egypt, Honduras and America.

Descriptive Types:

Name	*Characteristics*
Japanese	Round and short.
Honduras	Long and slender.
Blue rose	Medium.
Brown rice	Unpolished, without hollows.
Rice flour	Ground rice.
Rice polish	Consists of the ground rice coating and the leavings of the polished rice. This is a valuable cattle food.

OATS

Oats are harvested and stored in a manner similar to that used for wheat grain. Large acreage is employed in America and Europe, where it is popular as a cereal in the form of oatmeal (the ground kernel). Scotch style oatmeal consists of coarsely ground oat grains.

BARLEY

Barley is used in the manufacture of beer. The kernels are moistened, spread out on the floor, and allowed to sprout under controlled conditions of moisture, temperature and sprout growth. The grain is raised in America, Russia, Austria, Hungary, Chile, Germany and Scandinavia. Polished and Scotch style barley are called pearl barley and coarsely ground barley, respectively.

BUCKWHEAT

Buckwheat is grown in America, France, Russia and Germany. The flour is used for making buckwheat cakes and puddings.

STARCHES

Starch, a natural food stuff, is found in cereal grains, roots and tubers, in most vegetables and, to a some extent, in fruits. Modern processed starch has a bland or neutral taste, creamy smoothness and translucence. Starches are finding wide spread use in the manufacture of pies, pastrys, sauces and confectionery.

When starch is cooked in water the small opaque granules swell, becoming almost clear or translucent; prolonged cooking bursts these small granules or cells. The degree of cohesiveness, or shortness, of a hot or cold starch jelly will vary, depending on the kind of raw starch selected. A starch jelly, which maintains the same creaminess or efficiency in the hot and cold states is said to be stable.

In the preparation of corn starch puddings, the starch acts as the thickening agent (two ounces of starch are usually sufficient for one quart of milk). If a large egg is used in this mixture, about ½ ounce of starch may be omitted. However, if butter or cream is added, the starch content should be increased by at least ten percent. On the other hand, when starch is cooked in water, two ounces to a quart will form a tender cream jelly, while four ounces will form a very firm jelly. In fruit fillings of good quality (containing 50 to 60 percent solid fruit by weight), the starch content may vary from 2 to 6% of the batch weight, depending on the firmness desired. When the fruit content is lower, there must be a corresponding increase of starch to make up for body, handling quality, and shelf life. Lemon pie fillings, which are mixtures of water, acid, starch and eggs, require less starch as the egg content is increased. The consistency of starch jellies depends, more or less, upon other ingredients such as sugar, egg, fat, dry milk, corn syrup, salt, sodium benzoate, etc. For example, if one pound of starch is cooked with an average amount of juice or water in the presence of 7 pounds of sugar, the starch does not jell properly, regardless of the time or temperature employed. However, if the same amount of starch and liquid is processed with three or four times its weight of sugar, and the balance of the required sugar is introduced after the starch is swelled completely, the resulting jell will be clearer, glossier and will have a satisfactorily heavy body. For the same reason as explained above, too much egg, fat or dry milk solids present at the time that the starch is being cooked with water or milk, may inhibit the proper jelling development of the starch granules. When starch is heated for a long period in contact with fruit acids, there is considerable weakening of the jellied product. What happens is that the acid converts some of the starch into sugars. It is advisable that acids be

added after the starch has become clear and translucent or, better still, after the batch has been completely cooked.

CORN SYRUP

Starch making is essentially a process of separating mechanically starch from the other ingredients of the corn. The shelled corn is softened by steaming and is coarsely ground to loosen the germs (which are removed by flotation). The mass is then more finely ground, the hulls and fiber are screened out, and the resulting liquor, consisting of gluten and starch suspended in water, is run along narrow tables, where the starch settles to the bottom and the gluten and water run off. The substance left on the tables is starch which is further purified for marketing as commercial corn starch, or converted into corn syrup, corn sugar, or dextrose. The starch tables are long narrow troughs, about two feet wide and more than 100 feet long, with sides varying from 12 inches high at the head of the table to six and seven inches high at the foot. They are slightly inclined so that the starch liquor entering on the higher end moves very slightly to the other end where it overflows. The starch, being heavier than the gluten, settles to the bottom of the table. For further purification, it is flushed off the table with clean water, re-filtered and dried in kilns, through which a current of hot air circulates for about 24 hours. Air-dried starch contains from 13 to 18% water, while kiln-dried starch is practically moisture free (however, it readily absorbs from 7 to 10% moisture from the atmosphere). The form of the starch depends on the time of the drying; if it is completed within a few days, the product is a mixture of starch powder and larger particles, containing about 13% moisture. Commercially this form is known as pearl starch and is the basic starch of the corn products industry. When the drying process is prolonged, sometimes for weeks, the wet mass contracts irregularly and breaks up into distorted prisms or crystals; this product is crystal starch. Powdered starch is prepared by milling pearl starch and running it through a silk screen to remove the over-dried particles. Lump starch used for laundry purposes is made from powdered starch by treating it with steam, subjecting it to high pressure, crushing it and screening to size. All these starches are thick boilers that must be boiled to a thick paste. Thin boiling starches, which are used in the textile industry, are made from ordinary, thick boiling starch by heating with an acid to reduce the viscosity. The degree of viscosity produced depends upon the strength of the acid, heating temperature, and the duration of treatment.

In the manufacture of corn syrups and sugars, corn starch is suspended in water and heated with dilute hydrochloric acid under pressure. By

means of this treatment, the starch is converted to dextrose, maltose, dextrin, and other carbohydrates. The dextrose solution is neutralized with sodium carbonate, to remove excess acid, and passed through filter presses and bone-char filters, to remove all extraneous substances. Concentration of the liquid after several filtrations produces corn syrup (glucose) which is prepared for the market and sold to candy makers, bakers, etc. Corn sugar is made by allowing a concentrated sugar liquor to crystallize out on large tables. There are several grades of sugar, with different degrees of purification, on the market. When a pure dextrose is desired a special tank crystallizer is employed; the process requires several days and produces a dextrose from 99½ to 100% pure. Dextrins are produced by roasting dry starch in cookers, usually with the addition of mineral acid. Sometimes no acid is used, however, and the product of this conversion is called British gum. These dextrins are used in the manufacture of adhesives.

ARROWROOT (Maranta)

The true arrowroot is a starch obtained from the rootstock or rhizome of a West Indian plant, Bermuda arrowroot, and two or three related species, largely cultivated in tropical countries. The plant has been naturalized and thrives freely in the Gulf states. The name has been attributed to the Indian practise of using the fresh roots to cure wounds made by poisoned arrows.

When the plants are about a year old, they are dug out of the ground. In Bermuda and Jamaica they are first washed, the paper-like scale cleaned off, washed again, drained and, finally, beaten to a pulp in mortars or other machinery. The milky liquid thus obtained is passed through coarse cloths or sieves, washed many times with water, allowed to settle down, and finally dried, leaving the arrowroot of commerce.

High grade arrowroot is a light white powder, odorless when dry but giving off a very slight odor when mixed with boiling water, and swelling into a smooth jelly when cooked. It is used in biscuits, puddings, jellies and cakes, and also with beer, tea, milk, or boiled (with a little flavoring added) as an easily digested food for children and invalids.

TAPIOCA (Cassava or Manioc)

Tapioca flour or starch comes mostly from Java, although some of it is grown in Santo Domingo, South America and Cuba. The dry sliced roots of the cassava plant are known as "gaplek." The ground roots are called "gaplek meal." These products are used for food by the natives

of Java and may be used for the manufacture of starch. The cassava products are tapioca flour, pearls, seeds, flakes and siftings; the flour is the form generally used for most industrial purposes. The pearls and seeds are in globular form (the larger globes are pearls and the smaller ones, seeds), and are used entirely for food. Flakes and siftings are also used chiefly for food.

The starch is extracted from the root in much the same way as it is from potatoes. The starch cell is broken up by mechanical grating and the pulp conveyed, by flowing water, to a sieve through which the liberated starch grains pass, along with other impurities. As soon as the starch settles to the bottom of the settling tank, the liquid at the top is drawn off and the residue cut into blocks which are put into wooden tubs and purified. The purification process consists of vigorous stirring of the starch, replacing, and allowing it to settle with clean water, which is changed every 24 hours. This continues for about a week, when the starch is removed to drying shelves and, at the right time, broken by hand into small pieces. Tapioca flour is made by simply drying, pulverizing and screening. The flakes and siftings are made by cooking the starch in shallow pans for two or three minutes to produce a partial dextrinization; the starch is then sieved, spread over a surface and heated to 110° to 115° F. After 24 hours drying the product is ready for packing. To make tapioca pearls and seeds, the starch, after being broken up in the drying shed, is sieved and transformed to hammock-like contrivances suspended from the roof. A rocking motion, which is imparted by hand to these hammocks, causes the starch grains to adhere to one another. The particles are then graded as to size by screening, cooked in the same way as for flakes and siftings, again screened, and finally dried.

SAGO STARCH (Flour)

Sago is a starchy food prepared from the pith of the trunks of several tropical palms, particularly the sago palm of the East Indies. The tree has a hard, outer rind or shell about one inch in thickness, the whole inner portion being filled with a soft white substance that has the consistency of cheese, with numerous coarse, rather brittle fibres running through it.

In order to obtain the flour or starch, the palms are cut down, split lengthwise, the pith removed, powdered, and then washed with water to obtain the starch free from fibre, and other impurities. This sago meal is then made into a paste and rubbed through sieves of various sizes, producing the small "pearl" sago, the larger "bullet" sago, etc. The smaller particles cook more readily.

Sago is valuable as a food, since it is cheap and nutritious; it is prepared in the same manner as rice puddings. The impure sago flour imported to this country is called crude flour, contains woody fibres, and cooks up into a dark paste. However, some manufacturers are purifying the product, since it has been recognized for many years that sago has certain properties lacking in the other starches, which make it valuable to industry.

POTATO STARCH

The tubers or potatoes are ground to a pulp and freed of fibre by water washings. The plant consists chiefly of starch and a very small amount of protein. Large quantities are consumed, mixed with rye or wheat flour, in the making of bread. It is used for thickening gravies and in the preparation of sausage fillers.

SWEET POTATO STARCH

The process of manufacturing sweet potato starch is similar to that used for other group starches. The sweet potatoes are washed, ground and screened. The pulp is passed through a de-washing process and is sold for stock food. The starch milk from the screens is passed over tables to recover the starch. After the last traces of color have been removed by bleaching, the starch is dried and pulverized. Sweet potato starch can be prepared in technical form, although at present only the better starch is being marketed.

Approximate starch content of commercial ingredients before refinement

Arrowroot	23.00%
Barley flour	77.00%
Barley whole	73.00%
Corn flour	77.00%
Oatmeal, dry, uncooked	68.00%
Potatoes, fresh	19.00%
Rice, brown	78.00%
white	79.50%
Rye flour, dark	70.00%
medium	75.80%
light	78.50%
whole	75.20%
Sago flour	84.00%

Tapioca, dry	86.40%
Wheat, whole	72.40%
white	77.20%
cake	78.50%

MACARONI, SPAGHETTI, VERMICELLI, AND NOODLES

Although macaroni, spaghetti and similar pastes at one time were considered a typical Italian food, they have become an important part of the American diet.

The essential point in the manufacture of the pastes is that the meal or semolina, from which they are made, come from hard, very glutinous wheat, e.g., durum or macaroni wheat. The semolina is moistened with a minimum quantity of boiling water, mixed by machinery until smooth and tough, and worked up in a powerful machine kneader. The dough then goes into the cylinder of a press, under tremendous pressure, and it is slowly pressed out at the bottom of the cylinder through the small holes of a perforated plate. The plate shapes the product, which may have a pin hole in the center, it may be hollow or tubular, it may be a solid spaghetti, etc.

Pure durum wheat, semolina, etc., raw pastes are slightly golden in color and translucent. To determine purity a piece is broken; the fracture should be horny, not starchy. A more conclusive test is made by cooking the material in water; if the product becomes mushy or sticky, or does not retain its shape, it is probably a flour product or made from a wrong variety of wheat. Flour macaroni and flour spaghetti are inferior products, made from wheat flour or a mixture of semolina and wheat flour.

Noodles resemble the other forms of Italian paste as described above. However, noodles are made from ordinary flour instead of semolina. If noodles are sold as "Egg Noodles" they must contain not less than 5½% by weight of egg solids. Plain or "Water Noodles" are made without the addition of eggs and must be labeled "Water Noodles." Any artificial coloring is prohibited by law, and the moisture content must not exceed 13%.

SUGAR PRODUCTS

Sugar (sucrose) is derived from the sugar cane and sugar beet. The refined products are identical in chemical composition, appearance and flavor. The sugar cane yields about 16 to 21 percent of sucrose, whereas the sugar beet yields about 9%. The sugar cane is generally ripe for harvest after 12 to 16 months growth; it is then cut close to the ground

just before its flowering time, as the juice content is heaviest at this time. The sugar cane is cut, pressed, and the sucrose dissolved out with water. The sugar beet is treated in approximately the same manner. An average analysis of high grade sugar cane stalks shows about 72% water, 18% sugar and 10% woody and vegetable matter. One hundred tons of cane stalks will yield from seven to fourteen tons of sugar.

Types of Commercial Sugars

Cube sugar	Crystallized sugar cubes.
Loaf sugar	Crystallized in loaf shapes.
Powdered sugar	Coarsely powdered sugars.
XXXX Powdered sugar	Very finely pulverized sugar.
Confectioner's sugar	Very fine pulverized sugar with 3% added starch.
Brown sugar	Cane sugar with small percentage of molasses.
Yellow sugar	Cane sugar with traces of invert sugar and coloring matter. Nos. 1–15.
Other sugars:	
Maple	Derived from maple sap.
Corn	Derived from corn.
Levulose	Derived from fruits.
Maltose	Derived from malted barley.
Lactose	Derived from milk.
Corn syrup	Derived from corn starch.
Malt syrup	Derived from malted barley.
Invert sugar syrup	Derived from the action of acid on cane sugar.
Sugar cane syrup	Derived by evaporating the juice of the sugar cane.
Sugar syrup	Made by dissolving cane sugar in water.
Rock candy syrup	The uncrystallized syrup in the manufacture of rock candy.

FRUIT ESSENCES

Fruit essences are synthetic mixtures made to simulate, as closely as possible, the aroma of pure fruits and their juices. They are composed chiefly of ethers, esters, volatile oils and odorous substances. The fruit ethers are an intermediate product in re-inforcing the final flavor with alcohol, glycerin, sugar and other flavor carriers. The following formulae are to be considered as fruit flavor essences, and will be referred to as such in all formulae calling for these ingredients.

APRICOT FLAVOR ESSENCE
Formula No. 1.

Jasmine oil true	1/6	oz.
Ethyl butyrate	10	oz.
Ethyl valerianate	5	oz.
Ethyl salicylate	2	oz.
Amyl butyrate	1	oz.
Pettigrain oil	1½	oz.
Amyl alcohol	½	oz.
Peach flavor essence	2	oz.
Alcohol	16	oz.

APRICOT FLAVOR ESSENCE
Formula No. 2

Anisic aldehyde	1/3	oz.
Aldehyde C_{14}	3	oz.
Amyl acetate	5	oz.
Iris concrete (10% solution)	1¾	oz.
Bitter almond essence	1¾	oz.
Ionone (10% solution)	1/3	oz.
Jasmine absolute (solution)	1/30	oz.
Vanillin	1¾	oz.
Ethyl capronate	1¾	oz.
Ethyl acetate	3	oz.
Ethyl caprylate	2	oz.
Amyl butyrate	1¾	oz.
Amyl valerate	1¾	oz.
Eugenol	1/6	oz.
Alcohol	16	oz.

APPLE FLAVOR ESSENCE
Formula No. 1

Ethyl nitrite	1	oz.
Acetic aldehyde	¼	oz.
Ethyl acetate	1	oz.
Amyl valerianate	10	oz.
Cognac oil	¼	oz.
Ethyl butyrate	12	oz.
Amyl acetate	12	oz.
Alcohol	16	oz.

APPLE FLAVOR ESSENCE
Formula No. 2

Apple flavor essence	20	oz.
Iso butyl valerianate	3	oz.
Ethyl butyrate	2½	oz.
Methylethylphenyl gylcidate	1/8	oz.
Triacetin	20	oz.

APPLE FLAVOR ESSENCE
Formula No. 3

Cyclohexanyl acetate	1½	oz.
Cyclohexanyl valerianate	1/8	oz.
Amyl valerianate	2/3	oz.
Amyl formate	1/10	oz.
Geranyl acetate	2/3	oz.
Geraniol	½	oz.
Alcohol	16	oz.

ALMOND FLAVOR ESSENCE (BITTER)

Benzaldehyde	5	oz.
Benzyl alcohol	30	oz.
Neroli oil synthetic	1/30	oz.
Bitter almond oil	1/3	oz.
Vanillin	1/6	oz.
Alcohol	16	oz.

BUTTER FLAVOR ESSENCE
Formula No. 1

Diacetyl	6	oz.
Butyl acetate	½	oz.
Ethyl butyrate	1/3	oz.
Butyl butyrate	1/6	oz.
Triacetin	1½	oz.

BUTTER FLAVOR ESSENCE
Formula No. 2

Ethyl pelargonate	1/5	oz.
Ethyl butyrate	¼	oz.
Butyl butyrate	1/5	oz.
Butyl acetate	½	oz.
Diacetyl	5	oz.
Triacetin	2	oz.

BANANA FLAVOR ESSENCE

Ethyl butyrate	10	oz.
Amyl acetate	10	oz.
Pettigrain oil	1	oz.
Benzyl benzoate	2	oz.
Orange oil	1	oz.
Amyl butyrate	10	oz.
Alcohol	16	oz.

BUTTERSCOTCH FLAVOR ESSENCE

Ethyl genanthate	6	oz.
Ethyl pelargonate	12	oz.

Butyl butyrate	16	oz.
Amyl acetate	16	oz.
Ethyl butyrate	16	oz.
Butyric acid	16	oz.
Orange oil	½	oz.
Alcohol	16	oz.

CHERRY FLAVOR ESSENCE

Formula No. 1

Ethyl benzoate	5	oz.
Ethyl acetate	10	oz.
Benzyl benzoate	1	oz.
Cognac oil	½	oz.
Vanillin	½	oz.
Amyl alcohol	1	oz.
Alcohol	16	oz.
Bitter almond oil	2	oz.

Formula No. 2

Neroli oil synthetic	⅛	oz.
Vanillin	1	oz.
Clove oil	6	oz.
Cinnamon oil	2	oz.
Cognac oil	1½	oz.
Amyl alcohol	1½	oz.
Benzaldehyde (bitter almond oil)	4½	oz.
Ethyl pelargonate	2	oz.
Benzyl benzoate	8	oz.
Ethyl oenanthate	20	oz.
Ethyl acetate	64	oz.
Alcohol	16	oz.

CHERRY FLAVOR ESSENCE (SOUR)

Eugenol	½	oz.
Cognac oil	1	oz.
Cinnamic aldehyde	1	oz.
Benzoic aldehyde	9	oz.
Coumarin	2	oz.
Ethyl caprylate	2	oz.
Amyl acetate	8	oz.
Ethyl acetate	8	oz.
Bourbonal	5	oz.
Black currant flavor essence	½	oz.
Rose essence	½	oz.
Sweet orange essence	5	oz.
Lemon essence	40	oz.
Iris essence (1 to 70)	5	oz.
Vanillin	3	oz.
Amyl formate	5	oz.
Amyl butyrate	10	oz.
Alcohol	16	oz.

CACAO FLAVOR ESSENCE

Clove oil	3	oz.
Cinnamon	3	oz.
Vanillin	6	oz.
Benzyl alcohol	8	oz.
Ethyl oenanthate	12	oz.
Amyl butyrate	20	oz.
Amyl acetate	32	oz.
Ethyl acetate	40	oz.
Alcohol	16	oz.

COFFEE FLAVOR ESSENCE

Ethyl acetate	20	oz.
Ethyl formate	20	oz.
Ethyl pelargonate	10	oz.
Benzyl benzoate	7	oz.
Lemon oil	2	oz.
Cognac oil	½	oz.
Neroli oil synthetic	1/12	oz.
Alcohol	16	oz.

COGNAC FLAVOR ESSENCE

Amyl alcohol	5	oz.
Oenanthic ether	15	oz.
Alcohol	16	oz.

CURRANT FLAVOR ESSENCE (RED)

Formula No. 1

Amyl acetate	4	oz.
Isobutyl acetate	14	oz.
Amyl butyrate	18	oz.
Lemon oil	8	oz.
Orange oil	12	oz.
Pettigrain oil	½	oz.
Benzyl acetate	½	oz.
Cinnamon oil	¼	oz.
Neroli oil synthetic	1/30	oz.
Ethyl acetate	4	oz.
Alcohol	16	oz.

CURRANT FLAVOR ESSENCE (RED)

Formula No. 2

Cyclohexanyl valerianate	90	oz.
Ethyl benzoate	2	oz.
Propyl propionate	2	oz.

Amyl acetate	1	oz.
Propyl acetate	1	oz.
Alcohol	16	oz.

CURRANT FLAVOR ESSENCE (RED)

Formula No. 3

Cyclohexanyl butyrate	50	oz.
Methyl cinnamate	40	oz.
Aldehyde C_{16}	½	oz.
Oleoresin vanilla	1	oz.
Oil of Portugal	3	oz.
Oil of pettigrain	1	oz.
Orris	½	oz.
Alcohol	16	oz.

DATE FLAVOR ESSENCE

Honey flavor oil	½	oz.
Eugenol	¼	oz.
Peach flavor essence	1	oz.
Cinnamon oil	½	oz.
Neroli synthetic	¼	oz.
Amyl butyrate	5	oz.
Ethyl benzoate	10	oz.
Amyl valerate	10	oz.
Amyl acetate	18	oz.
Ethyl acetate	20	oz.
Alcohol	16	oz.

FIG FLAVOR ESSENCE

Fig extract (alcoholic)	2	lb.
Peach flavor essence	1/16	oz.
Raspberry flavor essence	½	oz.
Peppermint oil	1	drop

GINGER FLAVOR ESSENCE

Pettigrain oil	4	oz.
Cardamom oil	4	oz.
Clove oil	2	oz.
Galanga oil	1/39	oz.
Ginger oil	12	oz.
Ethyl oenanthate	20	oz.
Amyl butyrate	30	oz.
Ethyl acetate	20	oz.
Alcohol	16	oz.

GOOSEBERRY FLAVOR ESSENCE

Coumarin	1	oz.
Ethyl acetate	12	oz.
Amyl acetate	8	oz.
Ethyl butyrate	8	oz.
Ethyl benzoate	1	oz.
Fennel oil	⅛	oz.
Neroli oil synthetic	1/30	oz.
Alcohol	16	oz.

GRAPE FLAVOR ESSENCE

Formula No. 1

Ethyl formate	2	oz.
Ethyl oenanthate	10	oz.
Methyl anthranilate	10	oz.
Alcohol	16	oz.

Formula No. 2

Cognac oil, green	5	oz.
Methyl anthranilate	2	oz.
Ethyl cinnamate	3	oz.
Propyl cinnamate	3	oz.
Ethyl butyrate	½	oz.
Alcohol	16	oz.

GRENADINE FLAVOR ESSENCE

Formula No. 1

Benzaldehyde	2	oz.
Pettigrain oil	½	oz.
Peach flavor essence	6	oz.
Amyl valerate	6	oz.
Amyl acetate	3	oz.
Ethyl acetate	2	oz.
Benzoyl benzoate	4	oz.
Oil of cloves	¼	oz.
Cinnamon oil	¼	oz.
Alcohol	16	oz.

Formula No. 2

Peach flavor essence	2	oz.
Strawberry flavor essence	6	oz.
Vanillin	1/30	oz.
Alcohol	16	oz.

Formula No. 3

Cyclohexanyl valerianate	3	oz.
Amyl acetate	1½	oz.
Ethyl butyrate	1	oz.
Ethyl benzoate	1	oz.
Amyl butyrate	1	oz.
Ethyl salicylate	1	oz.
Vanillin	1/10	oz.
Alcohol	16	oz.

HONEY FLAVOR ESSENCE

Amyl valerate	15	oz.
Pelargonic ether	1	oz.

Ethyl acetate	50	oz.
Phenyl ethyl acetate	4	oz.
Ethyl butyrate	2	oz.
Alcohol	16	oz.

LEMON FLAVOR ESSENCE

Lemon oil	24	oz.
Orange oil	8	oz.
Amyl acetate	6	oz.
Amyl butyrate	16	oz.
Ethyl acetate	4	oz.
Alcohol	16	oz.

LIME FLAVOR ESSENCE

Lime oil	16	oz.
Lemon oil	16	oz.
Peppermint oil	¼	oz.
Amyl butyrate	4	oz.
Amyl acetate	4	oz.
Alcohol	16	oz.

MULBERRY FLAVOR ESSENCE (BLACKBERRY)

Ethyl acetate	12	oz.
Ethyl butyrate	24	oz.
Ethyl formate	3	oz.
Amyl acetate	2	oz.
Benzaldehyde	1/16	oz.
Ethyl pelargonate	¼	oz.
Ethyl oenanthate	¾	oz.
Benzyl acetate	1	oz.
Alcohol	16	oz.

MELON OIL FLAVOR ESSENCE

Ethyl formate	1	oz.
Ethyl butyrate	3	oz.
Amyl butyrate	2	oz.
Vanillin	¼	oz.
Lemon oil	1	oz.
Ethyl valerianate	4	oz.
Acetaldehyde	½	oz.
Alcohol	16	oz.

NUT FLAVOR ESSENCE

Butter flavor essence	1/16	oz.
Mace oil	1½	oz.
Bitter almond oil	½	oz.
Ethyl oenanthate	3	oz.
Vanillin	1/15	oz.
Orange oil	¼	oz.
Clove oil	1/30	oz.
Anise aldehyde	1/16	oz.
Alcohol	16	oz.

ORANGE FLAVOR ESSENCE (SWEET)

Lemon oil	4	oz.
Amyl acetate	4	oz.
Ethyl acetate	2	oz.
Sweet orange oil	12	oz.
Amyl butyrate	12	oz.
Alcohol	16	oz.

ORANGE FLAVOR ESSENCE (BITTER)

Bitter orange oil	12	oz.
Amyl butyrate	8	oz.
Pimenta oil	⅛	oz.
Pettigrain oil	2	oz.
Amyl acetate	3	oz.
Ethyl acetate	1	oz.
Alcohol	16	oz.

PEACH FLAVOR ESSENCE
Formula No. 1

Benzaldehyde	2	oz.
Ethyl valerianate	2	oz.
Amyl alcohol	¼	oz.
Pettigrain oil	¼	oz.
Pimenta oil	¼	oz.
Sweet orange oil	1	oz.
Vanillin	¼	oz.
Lemon oil	1	oz.
Amyl butyrate	1	oz.
Ethyl butyrate	2	oz.
Amyl acetate	4	oz.
Alcohol	16	oz.

PEACH FLAVOR ESSENCE
Formula No. 2

Cyclohexanyl butyrate	30	oz.
Ethyl cinnamate	7	oz.
Benzyl butyrate	7	oz.
Aldehyde C_{14}	1	oz.
Isobutyl salicylate	1	oz.
Amyl butyrate	3	oz.
Geranyl formate	½	oz.
Alcohol	16	oz.

PEAR FLAVOR ESSENCE
Formula No. 1

Amyl acetate	32	oz.
Ethyl acetic	10	oz.
Orange oil	2	oz.
Bergamot oil	1	oz.
Vanillin	½	oz.
Pettigrain oil	½	oz.
Oil of cloves	1/16	oz.
Alcohol	16	oz.

PEAR FLAVOR ESSENCE
Formula No. 2

Geraniol	½	oz.
Propyl propionate	¼	oz.
Ethyl cinnamate	5	oz.
Butyl acetate	1	oz.
Geranyl butyrate	2	oz.
Amyl formate	½	oz.
Alcohol	16	oz.

PINEAPPLE FLAVOR ESSENCE

Amyl butyrate	8	oz.
Ethyl butyrate	5	oz.
Ethyl acetate	2	oz.
Amyl acetate	10	oz.
Ethyl pelargonate	6	oz.
Ethyl sebacate	2	oz.
Butyric acid	1/20	oz.
Lemon oil	1/20	oz.
Vanillin	1/20	oz.
Alcohol	16	oz.

PISTACHIO FLAVOR ESSENCE

Pimento oil	½	oz.
Mandarin oil	1/10	oz.
Benzyl benzoate	1/10	oz.
Butyric acid	1/30	oz.
Heliotropin	⅕	oz.
Benzaldehyde	½	oz.
Peach flavor essence	¼	oz.
Nutmeg oil	¼	oz.
Orange oil	¼	oz.
Amyl acetate	½	oz.
Ethyl butyrate	1	oz.
Ethyl acetate	2	oz.
Ethyl oenanthate	½	oz.
Alcohol	16	oz.

PLUM FLAVOR ESSENCE
Formula No. 1

Amyl butyrate	3	oz.
Amyl formate	3	oz.
Ethyl formate	2	oz.
Ethyl acetate	1	oz.
Benzaldehyde	1	oz.
Amyl alcohol	½	oz.
Coriander oil	⅓	oz.
Clove oil	⅙	oz.
Mandarin oil	⅕	oz.
Lemon oil	1/20	oz.
Alcohol	16	oz.

PLUM FLAVOR ESSENCE
Formula No. 2 (GREEN GAGE)

Ethyl acetate	1	oz.
Amyl butyrate	2	oz.
Benzyl acetate	1/10	oz.
Ethyl butyrate	1	oz.
Ethyl oenanthate	1	oz.
Benzaldehyde	½	oz.
Ethyl pelargonate	⅓	oz.
Orange oil	⅕	oz.
Vanillin	1/20	oz.
Cognac oil	1/10	oz.
Amyl alcohol	1/10	oz.
Cinnamon oil	1/20	oz.
Clove oil	1/40	oz.
Rose oil	Trace	
Geranium oil	1/50	oz.
Alcohol	16	oz.

PRUNE JUICE FLAVOR ESSENCE

Ethyl acetate	3	oz.
Ethyl benzoate	2	oz.
Ethyl oenanthate	1	oz.
Amyl alcohol	½	oz.
Amyl acetate	⅙	oz.
Amyl butyrate	⅙	oz.
Almond oil	⅓	oz.
Cinnamon oil	1/10	oz.
Clove oil	1/10	oz.
Vanillin	1/40	oz.
Alcohol	16	oz.

POMEGRANATE FLAVOR ESSENCE

Tincture coccionella	1/10	oz.
Orange oil	1/10	oz.

Clove oil	1/10 oz.
Vanilla extract	1/2 oz.
Tincture of ginger	1/3 oz.
Maraschino essence	3 oz.
Alcohol	16 oz.

RASPBERRY FLAVOR ESSENCE
Formula No. 1

Terpeneless oil of cloves	5 oz.
Orris liquid (1% solution)	1 oz.
Cinnamon oil	5 oz.
Bitter almond oil	2 oz.
Rose oil	2 oz.
Phenyl ethyl alcohol	50 oz.
Benzyl acetate	40 oz.
Neroli synthetic	2 oz.
Peru balsam	10 oz.
Coumarin	1/4 oz.
Vanillin	1 oz.
Propyl acetate	10 oz
Amyl acetate	2 oz
Ethyl acetate	1/2 oz.
Alcohol	500 oz.

RASPBERRY FLAVOR ESSENCE
Formula No. 2

Amyl acetate	6 oz.
Amyl butyrate	1 1/2 oz.
Rose synthetic	1/4 oz.
Methyl benzoate	1/2 oz.
Nitrous ether	2 oz.
Ethyl acetate	6 oz.
Ethyl butyrate	1 oz.
Amyl valerate	1 1/2 oz.
Methyl cinnamate	1/2 oz.
Phenyl ethyl alcohol	2 oz
Alcohol	16 oz.

RASPBERRY FLAVOR ESSENCE
Formula No. 3

Isobutyl acetate	12 oz.
Amyl acetate	8 oz.
Ethyl acetate	5 oz.
Rose oil synthetic	1/64 oz.
Jasmine oil (10%)	1/16 oz.
Cinnamon oil	1/16 oz.
Clove oil	1/5 oz.
Pettigrain oil	1/5 oz.
Vanillin	1/4 oz.
Orris oil solution (10%)	1/4 oz.
Benzyl benzoate	1 oz.
Ethyl formate	1 oz.

RASPBERRY FLAVOR ESSENCE
Formula No. 4

Cyclohexanyl butyrate	9 oz.
Amyl formate	1/5 oz.
Ethyl benzoate	1/5 oz.
Amyl acetate	1/4 oz.
Aldehyde C_{14}	1/10 oz.
Vanillin	1/40 oz.
Alcohol	16 oz.

STRAWBERRY FLAVOR ESSENCE
Formula No. 1

Yara Yara (10% solution in benzyl benzoate)	1 oz.
Amyl acetate	3 oz.
Aldehyde C_{14}	1 1/2 oz.
Iris concrete (10% solution)	3/4 oz.
Bitter almond flavor essence	1/20 oz.
Rose essence	1/20 oz.
Jasmine essence	1/100 oz.
Ionone	1/100 oz.
Bourbonal	1/12 oz.
Alcohol	16 oz.

STRAWBERRY FLAVOR ESSENCE
Formula No. 2

Amyl formate	1/2 oz.
Cinnamon oil	1/30 oz.
Coumarin	1/20 oz.
Neroli synthetic	1/3 oz.
Ethyl benzoate	1/2 oz.
Amyl butyrate	1/6 oz.
Methyl salicylate	1/6 oz.
Ethyl butyrate	1 oz.
Ethyl acetate	1 oz.
Benzyl acetate	1 oz.
Amyl butyrate	1 oz.
Alcohol	16 oz.

STRAWBERRY FLAVOR ESSENCE
Formula No. 3

Ethyl cinnamate	5 oz.
Cyclohexanyl butyrate	5 oz.
Isobutyl valerianate	1/5 oz.
Methyl benzoate	1/15 oz.
Oleoresin vanilla	1/60 oz.
Alcohol	16 oz.

TANGERINE FLAVOR ESSENCE

Lemon oil	1	oz.
Bitter orange oil	1	oz.
Amyl acetate	1	oz.
Ethyl acetate	½	oz.
Mandarin oil	2	oz.
Amyl butyrate	3	oz.
Alcohol	16	oz.

UNIVERSAL FLAVOR ESSENCE

Amyl butyrate	4	oz.
Ethyl formate	12	oz.
Amyl acetate	12	oz.
Ethyl acetate	20	oz.

This formula is generally considered to constitute a neutral flavor. It is used for making up flavor compositions not previously mentioned and serves as a supplementary flavor essence.

WALNUT FLAVOR ESSENCE

Formula No. 1

Cardamom oil	1/50	oz.
Lemon oil	1/10	oz.
Anisaldehyde	1/10	oz.
Butyric acid	1/30	oz.
Clove oil	1/40	oz.
Orange oil	1/6	oz.
Benzaldehyde	1/6	oz.
Vanillin	1/30	oz.
Nutmeg oil	¾	oz.
Amyl valerate	3	oz.
Ethyl oenanthate	3	oz.
Ethyl acetate	3	oz.
Alcohol	16	oz.

WALNUT FLAVOR ESSENCE

Formula No. 2

Clove oil	1	oz.
Cardamom oil	¼	oz.
Lemon oil	½	oz.
Anisette oil	½	oz.
Butyric acid	¾	oz.
Orange oil	2	oz.
Benzaldehyde	2	oz.
Vanillin	1	oz.
Mace oil	4	oz.
Ethyl oenanthate	10	oz.
Amyl valerate	10	oz.
Ethyl acetate	20	oz.
Alcohol	16	oz.

ARTIFICIAL FRUIT, FOOD AND SOFT DRINK FLAVORS

The artificial flavors that follow are used for flavoring bakery goods, condiments, soft drinks and various other food products. Flavors should be used sparingly, since they are very aromatic, odorous substances. The amount to be used per unit of food or liquid must be decided upon after experimentation. Oil soluble food colors may be added to flavors if desired.

APPLE FLAVOR

Apple flavor essence	1	oz.
Orange flavor essence	1	oz.
Alcohol	6	oz.

APRICOT FLAVOR

Apricot flavor essence	4	oz.
Peach flavor essence	¼	oz.
Benzaldehyde	1/16	oz.
Oenanthic ether	1/16	oz.
Aldehyde C_{14}	1/30	oz.
Alcohol	6	oz.

BANANA FLAVOR

Banana flavor essence	1	oz.
Lemon flavor essence	¼	oz.
Orange flavor essence	¼	oz.
Alcohol	6	oz.

BITTER ALMOND FLAVOR

Bitter almond oil	1	oz.
Alcohol	6	oz.

BISCUIT AND CAKE FLAVOR

Benzaldehyde	1	oz.
Clove oil	1/10	oz.

Vanillin	1/10 oz.
Alcohol	6 oz.

BITTER ORANGE FLAVOR

Lemon flavor essence	2 oz.
Bitter orange flavor essence	2 oz.
Orange flavor essence	6 oz.
Alcohol	6 oz.

BLACKBERRY FLAVOR

Raspberry flavor essence	1 oz.
Currant flavor essence	1 oz.
Lemon flavor essence	1/3 oz.
Blackberry flavor essence	3 oz.
Alcohol	6 oz.

BUTTER FLAVOR

Butyric acid	1 oz
Ethyl butyrate	3/4 oz.
Amyl butyrate	1 oz
Alcohol	6 oz.

BUTTERSCOTCH FLAVOR

Butterscotch flavor essence	4 oz.
Benzaldehyde	1/5 oz.
Alcohol	6 oz.

CARAMEL FLAVOR

Coffee extract	4 oz.
Maple flavor	2 oz.
Vanillin	1/8 oz.
Coumarin	1/30 oz.
Brown food color	Enough
Alcohol	6 oz.

CHERRY FLAVOR

Benzaldehyde	1 oz.
Clove oil	1/8 oz.
Cinnamon oil	1/8 oz.
Cherry flavor essence	12 oz.
Alcohol	6 oz.

COCOANUT FLAVOR

Walnut flavor essence	6 oz.
Cocoanut flavor essence	32 oz.
Butyric acid	2 oz.
Orange oil	1 oz.
Benzaldehyde	1/8 oz.
Mace oil	1/4 oz.
Clove oil	1/2 oz.
Alcohol	16 oz.

BLACK CURRANT FLAVOR

Currant flavor essence	7 oz.
Black currant essence	32 oz.
Neroli synthetic	1/16 oz.
Vanillin	1/8 oz.
Alcohol	6 oz.

CREAM SODA FLAVOR (Vanilla)

Vanillin	3 oz.
Coumarin	1 oz.
Alcohol	6 oz.

COFFEE CAKE FLAVOR

Coffee extract	1/2 oz.
Orange oil	1/4 oz.
Lemon oil	1/4 oz.
Benzaldehyde	1/30 oz.
Cassia oil	1/16 oz.
Alcohol	6 oz.

FIG FLAVOR

Peach flavor essence	1/4 oz.
Raspberry flavor essence	2 oz.
Peppermint oil	1/60 oz.
Vanillin	1/60 oz.
Date flavor essence	6 oz.
Fig flavor essence	12 oz.
Alcohol	6 oz.

FRUITY CAKE FLAVOR

Pineapple flavor essence	1 oz.
Strawberry flavor essence	1 oz.
Cherry flavor essence	1 oz.
Prune flavor essence	1 oz.
Alcohol	6 oz.

GRAPE FLAVOR

Currant flavor essence	4 oz.
Pineapple flavor essence	5 oz.
Grape flavor essence	6 oz.
Alcohol	6 oz.

PEAR FLAVOR

Vanillin	1/3 oz.
Coumarin	1/10 oz.
Bergamot oil	1/4 oz.
Lemon flavor essence	1 oz.
Currant flavor essence	1 oz.
Pear flavor essence	3 oz.
Alcohol	6 oz.

GRENADINE FLAVOR

Vanillin	1/10	oz.
Strawberry flavor essence	1	oz.
Grenadine flavor essence	2	oz.
Raspberry flavor essence	4	oz
Peach flavor essence	4	oz.
Alcohol	6	oz.

GINGER CAKE FLAVOR

Apricot flavor essence	1	oz.
Cardamom oil	2	oz.
Clove oil	1	oz.
Ginger oil	3	oz.
Lemon oil	3	oz.
Alcohol	6	oz.

GREEN GAGE FLAVOR

Green gage flavor essence	2	oz.
Eugenol	1/16	oz.
Coumarin	1/16	oz.
Alcohol	6	oz.

HONEY FLAVOR

Honey flavor essence	2	oz.
Raspberry flavor essence	1/8	oz.
Rose water	2	oz.
Alcohol	6	oz.

LEMON FLAVOR

Lemon oil	1/4	oz.
Lemon flavor	4	oz.
Alcohol	6	oz.

LIME FLAVOR

Lime oil	1/2	oz.
Lime flavor essence	4	oz.
Alcohol	6	oz.

MACAROON TART FLAVOR

Benzaldehyde	3	oz.
Peach flavor essence	1/2	oz.
Orange oil	1/16	oz.
Alcohol	6	oz.

MARASCHINO FLAVOR

Maraschino flavor essence	3	oz.
Universal flavor essence	1/3	oz.
Alcohol	6	oz.

MELON FLAVOR

Vanillin	1/10	oz.
Orange flavor essence	1	oz.
Melon flavor essence	3	oz.
Alcohol	6	oz.

MINT JELLY FLAVOR

Peppermint oil	3	oz.
Orange oil	1/8	oz.
Alcohol	6	oz.

NECTARINE FLAVOR

Peach flavor essence	1	oz.
Plum flavor essence	1/4	oz.
Vanillin	1/10	oz.
Alcohol	6	oz.

PEACH FLAVOR

Apple flavor essence	2	oz.
Peach flavor essence	12	oz.
Vanillin	1/8	oz.
Alcohol	6	oz.

PINEAPPLE FLAVOR

Pineapple flavor essence	1	oz.
Alcohol	6	oz.

PISTACHIO FLAVOR

Cognac oil	1/8	oz.
Benzaldehyde	1/4	oz.
Vanillin	1/30	oz.
Pistachio flavor essence	2	oz.
Peach flavor essence	2	oz.
Butyric acid	1/8	oz.
Alcohol	6	oz.

PLUM FLAVOR

Heliotropin	1/16	oz.
Plum flavor essence	1	oz.
Alcohol	6	oz.

RASPBERRY FLAVOR

Raspberry flavor essence	12	oz.
Currant flavor essence	6	oz.
Alcohol	6	oz.

STRAWBERRY FLAVOR

Strawberry flavor essence	4	oz.

Raspberry flavor essence	1	oz.
Alcohol	6	oz.

WALNUT FLAVOR
Formula No. 1

Walnut flavor essence	2	oz.
Coumarin	1/16	oz.
Lovage oil	1/30	oz.
Alcohol	6	oz.

WALNUT FLAVOR
Formula No. 2

Mace oil	½	oz.
Benzaldehyde	⅓	oz.
Vanillin	⅛	oz.
Lemon oil	½	oz.
Butyric acid	¼	oz.
Peach flavor essence	¾	oz.
Nut flavor essence	2	oz.
Alcohol	6	oz.

SPICY FLAVORS

SPICE MEAT EXTRACT

Mace extract	¾	oz.
Clove extract	⅛	oz.
Thyme extract	¾	oz.
Basil extract	¾	oz.
Shallott extract	7	oz.
Celery extract	4	oz.

SPICE FISH EXTRACT

Onion extract	4	oz.
Pepper extract	1	oz.
Pimenta extract	1	oz.
Ginger extract	⅛	oz.
Clove extract	⅛	oz.
Bay laurel extract	¼	oz.

SPICE SAUSAGE EXTRACT

Savory extract	1	oz.
Pimenta extract	2	oz.
Pepper extract	5	oz.
Onion extract	6	oz.
Bay laurel extract	⅛	oz.

SPICE SMOKED MEAT EXTRACT

Savory extract	1	oz.
Cardomom extract	½	oz.
Basil extract	2	oz.
Pepper extract	4	oz.
Garlic extract	8	oz.

SPICE PICKLE EXTRACT

Celery extract	1½	oz.
Clove extract	¾	oz.
Dill extract	1¼	oz.
Pimenta extract	2½	oz.
Capsicum extract	3	oz.
Pepper extract	4	oz.

SPICE CURRY EXTRACT

Turmeric extract	2	oz.
Ginger extract	2	oz.
Pepper extract	4	oz.

SPICE TARRAGON EXTRACT

Tarragon extract	6	oz.
Celery extract	1½	oz.

SPICE MIXED PICKLE EXTRACT

Tarragon extract	½	oz.
Dill extract	1	oz.
Pimenta extract	2	oz.
Capsicum extract	2	oz.
Caper extract	3	oz.
Shallott	3	oz.

SPICE MUSTARD PICKLE
EXTRACT

Dill extract	1	oz.
Pepper extract	¾	oz.
Celery extract	½	oz.
Capsicum extract	½	oz.
Onion extract	½	oz.
Cardomom extract	½	oz.
Mustard oil volatile	1/30	oz.

Spicy culinary extracts are generally manufactured by dissolving ½ to 1½ ounces of the essential (spice) oil in about 12 ounces of pure al-

cohol, and then adding two to three ounces of water. Extracts such as garlic, onion, celery, etc., are best manufactured by allowing the latter to soak in dilute alcohol and then drawing off the clear liquid for use as a flavor.

Spice salts are made by simply rubbing the salt and the spice extracts together and then air drying.

SPICE VINEGAR FLAVORS

TARRAGON VINEGAR

Tarragon oil	1	oz.
Cognac flavor	1/8	oz.
Alcohol	16	oz.

FRUIT VINEGAR

Cognac flavor	1/8	oz.
Strawberry flavor essence	1	oz.
Raspberry flavor essence	3	oz.
Ethyl acetate	1/2	oz.
Alcohol	16	oz.

MUSTARD VINEGAR

Mustard oil volatile	1/8	oz.
Pimenta oil	1/4	oz.
Peppermint oil	1/30	oz.
Tarragon oil	1	oz.
Alcohol	16	oz.

WINE VINEGAR

Cognac flavor	1/4	oz.
Celery oil	1/2	oz.
Ethyl acetate	3/4	oz.
Alcohol	16	oz.

MALT VINEGAR

Cognac flavor	1/8	oz.
Ethyl acetate	1/4	oz.
Cardamom oil	1/30	oz.
Alcohol	16	oz.

UNIVERSAL VINEGAR ESSENCE

Tarragon oil	1	oz.
Celery oil	1/2	oz.
Thyme oil	1/2	oz.
Pimenta oil	1/8	oz.
Clove oil	1/30	oz.
Alcohol	16	oz.

CELERY VINEGAR

Tarragon oil	1/2	oz.
Celery seed oil	1 1/2	oz.
Alcohol	16	oz.

POLISHES FOR CHOCOLATE COATED CANDIES

Where the food laws permit, lacquer coatings are used on chocolate coated candies. The candy takes on a high sheen, making for better appearance; the coating also retards sticking, especially during the summer months. The simplest way of using lacquer coatings is to sponge the polish on the candies while they are being rotated in a chocolate pan. The lacquer dries rather quickly, leaving a polished surface. The pan is equipped with hot and cold air controls, and the inside is always coated with a thin layer of carnauba wax.

SHELLAC LACQUER COATING
Formula No. 1

Edible white shellac	1	lb.
Pure alcohol	7	pt.
Ethyl acetate	1	pt.

SHELLAC LACQUER COATING
Formula No. 2

Gum benzoin	1	lb.
Pure alcohol	8	pt.

SHELLAC LACQUER COATING
Formula No. 3

Edible shellac	1	lb.
Gum sandarac	1	lb.
Pure alcohol	8	pt.
Soluble brown dye	1	oz

SHELLAC LACQUER COATING
Formula No. 4

Gum mastic	4	oz
Edible shellac	1	lb.
Brown dye	¼	oz.
Gum sandarac	1	lb.
Alcohol	8	pt.

SALT

Salt is essentially sodium chloride, any other ingredients being incidental impurities. The four chief methods of obtaining it are by: (1) evaporation of the brine from wells sunk into salt beds, (2) mining, (3) evaporation of sea water, and (4) evaporation of the brine of natural springs. The chief producing states are Michigan, New York, Ohio and Kansas.

Mined salt is taken out of the beds in a dry state and is known as "rock salt." It is ground in crushers, sifted, and refined into numerous grades for marketing. Salt to which a very small percentage of potassium iodide has been added is called "iodized salt."

Composition of Table Salt

Sodium chloride	98.25%
Insoluble residue	.08%
Calcium sulphate	1.31%
Magnesium chloride	.10%
Sodium sulphate	.26%

Salt is a condiment that is necessary to the human (and animal) diet; it gives zest to foods and diets deficient in salt are unpalatable. It is used for brining of pickles, olives and many other foods. The instrument used for measuring salt concentrations is the "Salometer." While this is the method generally used, the Baumé hydrometer can also be used and the following table shows the Baumé degrees as compared with Salometer degrees.

SODIUM CHLORIDE BRINE TABLE

Salometer Reading 60° F	Baumé Reading 60° F	Percentage of Salt in Brine by weight
0	0.0	0.000
2	0.6	0.528
4	1.0	1.056
6	1.6	1.584
8	2.1	2.112
10	2.7	2.640
12	3.3	3.167
14	3.7	3.695
16	4.2	4.223
18	4.8	4.751
20	5.3	5.279
22	5.8	5.807
24	6.4	6.335
26	6.9	6.863
28	7.4	7.391
30	7.9	7.919
32	8.5	8.446
34	9.0	8.974
36	9.5	9.502
38	10.0	10.030
40	10.5	10.558
42	11.0	11.086
44	11.5	11.614
46	12.0	12.142
48	12.5	12.670
50	12.9	13.198
52	13.4	13.725
54	13.9	14.253
56	14.4	14.781
58	14.8	15.309
60	15.3	15.837
62	15.8	16.365
64	16.2	16.893
66	16.7	17.421
68	17.2	17.949
70	17.7	18.477

Salometer Reading 60° F	Baumé Reading 60° F	Percentage of Salt in Brine by weight
72	18.1	19.004
74	18.6	19.532
76	19.1	20.060
78	19.6	20.588
80	20.0	21.116

FOOD COLORS AND HOW TO USE THEM

Certified food colors are employed in the preparation of foods, candies, syrups, etc. There is no longer any reason for the consumer to look suspiciously at an attractively colored food preparation, since the use of harmful chemicals for coloring purposes is now definitely prohibited by law. Any tint or shade desired can now be obtained by the wise and careful selection and blending of certified food colors. The government has specified those colors that may be used in food manufacture and each color must now pass rigid chemical tests in order to safeguard the consumer. The use of coloring matters in foods, nevertheless, still deserves close inspection and regulation to safeguard against the use of uncertified colors by unscrupulous manufacturers. Colors may be manufactured both in paste and liquid forms.

CERTIFIED FOOD COLORS

(Selected By The United States Department Of Agriculture)

Primary Colors

Red	Erythrosine	
	Amaranth	
	Ponceau 3R	
	Ponceau SX	
Orange	Orange I	
Green	Guinea Green	
	Light Green S. F.	
	F.C.F. Green	
Blue	Sodium indigo disulphonate	
Yellow	Tartrazine	
	Yellow A. B.	Soluble in oil only
	Yellow O. B.	Soluble in oil only

Secondary and Tertiary Colors

These colors can be made by blending two or more primary colors.

Solubility Chart for Certified Food Colors

When certified colors are used in foods, it is important that the color be kept uniform. However, because of the varying solubility of the dyes at different temperatures, it is highly important that standard color solutions be prepared and maintained with the foregoing principle in mind.

The following chart prepared by the laboratories of Wm. J. Strange Co., Chicago, is useful to anyone who is concerned with formulas or quality control.

Solubility Chart for Certified Food Colors
Degrees Fahrenheit

	Freezing	40°	50°	60°	70°	80°	90°	100°	110°	120°	130°
Ponceau 3R	6.2	10.9	13.6	15.1	16.7	17.9	19.1	20.3	21.5	22.5	22.8
Orange I	1.5	1.9	2.2	2.5	2.7	3.2	4.0	5.0	8.6	13.2	17.5
Tartrazine	5.9	6.2	8.1	10.3	14.9	21.4	35.3	41.5	45.9	48.8	49.9
Amaranth	3.1	12.1	17.7	20.9	22.9	26.0	28.2	30.4	31.9	33.6	35.3
Guinea Green	12.0	18.0	24.0	30.0	33.2	36.0	38.4	42.2	46.0	48.6	51.2
Fast Green	12.0	18.0	24.0	30.0	33.2	36.0	38.4	42.2	46.0	48.6	51.2
Erythrosine	5.0	6.2	7.4	8.6	10.	11.4	12.8	14.4	16.0	17.6	19.3
Indigotine	.8	.9	1.1	1.3	1.5	1.7	1.9	2.1	2.3	2.5	2.8
Sunset Yellow	9.2	23.0	28.0	30.9	33.7	35.6	37.4	39.2	40.9	42.6	43.8
Ponceau SX	1.25	2.5	5.0	7.4	8.6	9.8	10.4	11.0	11.5	11.8	12.1
Naph. Yellow	10.9	12.1	13.2	14.3	16.0	17.7	20.3	23.0	26.0	29.5	32.8
Light Green	Very soluble. 25% will remain in solution even at freezing.										
Brill Blue	Very soluble. 32% will remain in solution even at freezing.										

This chart indicates the number of ounces of color which will remain in solution in distilled water to make a gallon of finished liquid at a given temperature. In dissolving the above colors, the solution must be heated to at least 50° F. above the temperature indicated by the chart.

Compounded Food Colors

Yellow		Golden-Yellow	
Tartrazine	9 oz.	Tartrazine	75 oz.
Amaranth	1 oz.	Orange I	25 oz.
Egg Shade		or	
Tartrazine	14½ oz.	Tartrazine	15¼ oz.
Orange I	1½ oz.	Orange I	¾ oz.

Peach Color

Ponceau	1 lb. 4	oz.
Tartrazine	10	oz.

Yellow-Orange

Orange I	9	oz.
Tartrazine	1	oz.

Orange (Yellowish)

Tartrazine	50	oz.
Orange I	50	oz.

Reddish-Orange

Orange I	9	oz.
Amaranth	1	oz.

Orange-Red

Ponceau	75	oz.
Tartrazine	30	oz.

Violet

Amaranth	88	oz.
Sodium indigo disulphonate	42	oz.

Royal Purple

Amaranth	8	oz.
Sodium indigo disulphonate	2	oz.

Grape

Amaranth	2	oz.
Sodium indigo disulphonate	¼	oz.

Green

Tartrazine	6 or 6.5	oz.
Sodium indigo disulphonate	4 or 3.5	oz.

Brilliant Green

Tartrazine	10	oz.
Sodium indigo disulphonate	6	oz.

Yellow-Green

Sodium indigo disulphonate	4	oz.
Tartrazine	12	oz.

Mint Green

Tartrazine	7	oz.
Sodium indigo disulphonate	3	oz.

Creme de Menthe Green

Light Green S.F.	48	oz.
Tartrazine	52	oz.

Olive Green

Sodium indigo disulphonate	4	oz.
Orange I	1½	oz.
Tartrazine	10½	oz.

Leaf Green

Light green

Deep Red

Ponceau	75	oz.
Amaranth	25	oz.

Ruby Red

Amaranth

Striping Red

Erythrosine	10	oz.
Amaranth	30	oz.
Ponceau	60	oz.

Carmine Red

Erythrosine	90	oz.
Ponceau	10	oz.

Cherry Red

Ponceau

Sherry Red

Amaranth	12	oz.
Orange	4	oz.

Raspberry Red

Amaranth

Grenadine Red

Amaranth

Strawberry Red

Amaranth	8.5	oz.
Orange I	1.5	oz.

Brown

Orange I	13	oz.
Sodium indigo disulphonate	8	oz.
Amaranth	3	oz.
Tartrazine	2	oz.

Almond Brown (Reddish-brown)

Orange I	13¾	oz.
Amaranth	2¼	oz.

Chocolate Brown

Sodium indigo disulphonate	28	oz.
Amaranth	20	oz.
Tartrazine	40	oz.
Orange I	12	oz.

Liquid Colors

Liquid colors can be made by dissolving four ounces to one gallon of any of the dye formulas outlined on the previous pages. The addition of

one pound of glycerine to each gallon of liquid color will be sufficient to retard the development of molds or fermentation. However, in order to positively guarantee no fermentation in a liquid color preparation, ¼ ounce of sodium benzoate, dissolved in a little water, and ⅛ of an ounce of citric acid, should be added.

Paste Colors

Recently manufacturers have put out paste color preparations, sold as a specified weight tablet or block, which when added to a definite volume of a liquid or solid will result in the desired shade. These paste colors are easily made by adding one pound of color to 3½ pints of warm glycerine. The mixture is stirred until all of it is dissolved and then eight pounds of confectioner's sugar, free from lumps, is slowly added. The heating is continued until a smooth paste is obtained.

VEGETABLE COLORS

GREENS	1. CHLOROPHYLL 2. By mixing TINCTURE OF SAFFRON or TINCTURE OF TURMERIC with a solution of INDIGO CARMINE (made from the paste) in various proportions a variety of green shades can be obtained.
REDS	COCHINEAL SYRUP and CARMINE
YELLOWS	TINCTURE OF SAFFRON and TINCTURE OF TURMERIC
BROWNS	CARAMEL (Burnt Sugar)
BLUES	INDIGO CARMINE PASTE
VIOLET	By mixing RED + BLUE
ORANGES	TINCTURE OF ANNATTO and by mixing RED + YELLOW
GRAYS	By mixing RED + GREEN or RED + BLUE + YELLOW

TINCTURE OF CHLOROPHYLL

Extract green spinach with diluted alcohol and evaporate to paste. Use 1 part paste to 10 parts alcohol and filter—or—moisten fine, hacked grass with water and press. Boil the juice and decant the greenish liquid. Press the residue off from the surplus liquid and extract the residue with alcohol. Filter and evaporate. Take up the residue in hot water. The insoluble separating greenish flocky mass is dissolved in hydrochloric acid and finally precipitated with water.

TINCTURE OF SAFFRON

Saffron	3 oz.
Water	1 qt.
Alcohol	1 qt.

Macerate several days and filter.

TINCTURE OF TURMERIC

Turmeric (Bruised)	1 oz.
Diluted Alcohol (50–50)	6 oz.

Macerate in a closed vessel for 7 days and filter.

COCHINEAL SYRUP

Powdered Cochineal	12 oz.
Potassium Bicarbonate	4 oz.
Distilled Water	30 oz.
Alcohol	24 oz.

Rub the potassium bicarbonate with the cochineal powder. Mix the alcohol and water and add to the powder. Filter, then mix the solution with

Syrup	120 oz.

thoroughly.

TINCTURE OF CARMINE

Carmine	22 oz.
Strong Ammonia Water (Enough to dissolve the carmine)	
Distilled Water, enough to make	500 oz.

Dissolve the carmine in the ammonia water and add the distilled water.

TINCTURE OF INDIGO CARMINE

Dissolve in distilled water any amount of the indigo carmine paste to get the desired strength or shade. Usually

Paste	1 oz.
Warm Water	20 oz.

Dissolve, filter, and add 5% alcohol.

TINCTURE OF ANNATTO

One hundred ounces of annatto are extracted with 150 ounces of water, containing 1½% potassium carbonate. Evaporating to 60 ounces, add 12 ounces of alcohol and filter.

Used for coloring butter and cheese.

SUGAR COLORING (Caramel Color)

Add 2 gallons of water to 10 gallons of caramel.

COLORING MATERIALS FOR LIQUEURS

RED

1. Steep 4 ounces of raspings of RED SANDERS WOOD in a pint of strong spirits of wine for 2 weeks. Strain and filter.

	2. Steep 3 ounces of COCHINEAL, finely powdered, in a pint of strong spirits of wine for 2 weeks; add 2 drams of powdered alum and filter clear.
BLUE	Steep 4 drams of INDIGO in a bottle with 2 ounces of SULPHURIC ACID for several days, frequently putting the bottle into hot water, add ½ pint (8 ounces) of distilled water and filter.
YELLOW	Steep 1 ounce of SAFFRON in ½ pint of spirits of wine for a week; filter.
GREEN	Mix equal parts of Blue and Yellow coloring.
VIOLET	Mix 1 part of Blue with 2 of Red coloring.
PINK	Steep 4 ounces of CUDBEAR in a quart of strong spirits for 2 weeks; filter.
BROWN	Add 2 gallons of water to 10 gallons of CARAMEL.

PREPARATION AND USE OF STABILIZER SOLUTIONS IN WHIPPED CREAM

The following instructions are given for preparing and using stabilizer solutions on the basis of 10 gallons of cream-stabilizer mixture:.

Sodium Alginate:

Weigh out 2¾ ounces of sodium alginate. Place in two quarts of cold water and heat to 160°–170° F. by placing the container in hot water. Stir frequently during heating. Heat 80 pounds of 34% cream to 160°–165° F. and add the hot stabilizer solution to the hot cream. Mix well and cool to 40°–50° F. Age twenty-four hours before whipping. The cream-stabilizer mixture will make ten gallons of a product containing 32.3% butterfat and approximately 0.2% sodium alginate.

Gelatin:

Weigh out 4¾ ounces of gelatin. Place in two quarts of cold water and heat to 140°–143° F. by placing the container in hot water. Stir frequently during heating. Heat 80 pounds of 34% cream to 140°–143° F. and add the hot stabilizer solution to the hot cream. Mix well and cool to 40°–50° F. Age twenty-four hours before whipping. The cream-stabilizer mixture will make ten gallons of a product containing 32.3% butterfat and approximately 0.35% gelatin.

CONCLUSIONS

The experimental work herein reported shows that the production of whipped cream for sale as such is entirely feasible. Whipped cream might advantageously be added to the list of other dairy products offered to the public by the milk dealer.

In a comparison of Guernsey and Ayrshire cream for whipping purposes, these experiments show that Guernsey cream can be whipped in less time than Ayrshire cream. Also, the fat loss in the drainage from the whipped cream is considerably less with Guernsey whipped cream than with Ayrshire whipped cream. This may be explained on the basis of the average volume of the fat globules found in the two creams, those in the Guernsey cream having the greater average volume.

The temperature at which whipped cream is stored affects its stability and the amount of fat lost in the drainage. The whipped cream stored at 40° F. had the best stability as evidenced by the amount of drainage taking place. However, little difference was noted between the samples stored at 40° F. and 52° F. Samples stored at 60° F. and 76° F. showed considerable drainage, the greater amount taking place at the higher temperature.

Temperature had little effect on total fat loss when maintained at or below 64° F. However, considerable loss of fat occurred at 76° F. Also whipped cream stored at 76° F. has a tendency to become slightly sour at the end of twenty-four hours.

In so far as fat loss is concerned, whipped cream should not be stored at temperatures above 64° F. However, when considering stability and keeping quality, a storage temperature of 52° F. or lower is to be preferred.

Good stability and little loss of fat in the drainage are desired in high quality whipped cream. A product in which these qualities may be lacking under normal conditions, may be made to possess such qualities by the addition of a stabilizer to the cream prior to whipping.

Sodium alginate and gelatin have both proven satisfactory for increasing stability of, and decreasing fat loss in the drainage from whipped cream. The use of such substances is recommended in the manufacture of whipped cream wherein it is impossible to otherwise obtain these qualities. However, prior to use, the fact must be established whether or not the use of such substances violates existing city or state laws governing the composition of whipped cream.

Comparing the relative advantages of the two stabilizers, the type of whipper must be considered. Whipped cream produced by means of the air whip and containing gelatin possesses greater stability with less fat

loss in the drainage than that containing sodium alginate as the stabilizer. Whipped cream produced by means of the turbine whipper and containing gelatin possesses greater stability with a greater fat loss in the drainage than that containing sodium alginate as the stabilizer.

When sodium alginate was used as the stabilizer, the body of the whipped cream was apparently normal. When gelatin was used as the stabilizer, the body of the whipped cream was slightly soggy and sticky, this defect being more pronounced when the turbine whipper was used. This defect, however, was not sufficiently serious to be objectionable except possibly for a very discriminating trade.

Differences noted on the various results of the use of sodium alginate and gelatin as stabilizers in cream for whipping are not sufficiently great to warrant a statement in regard to which should be recommended.

Both sodium alginate and gelatin increased the viscosity of the cream and reduced the overrun.

The type of whipper used is an important factor in obtaining the desired overrun. Under all conditions the overrun was approximately doubled by the use of the air whip compared to the turbine whipper. The body of the whipped cream produced by the air whip was more desirable even though it had a more open structure than the whipped cream produced by the turbine whipper.

The air whip was found to be the better of the two types of whippers used for the production of whipped cream.

POWDERED AND FLAKED EGG WHITES

The moisture content of powdered fresh egg whites is usually standardized at about 8½%, when ready for shipment, although flaked albumen may run as high as 12 to 18% in moisture. A pure egg white powder should be almost completely soluble in water, free from unwholesome odor and have a nice white color. Powdered dry whites are almost sterile as they come out of the drying equipment; the bacteria count is very low and only in the presence of excess moisture and high humidity does it increase over a period of time. The whipping quality of the dried egg white is practically the same as that of the original egg albumen. The primary mechanical function of dried egg whites or albumen is aeration, (incorporation of air) of the batch of cake or marshmallow so that it will be lighter in weight, shorter and smoother in texture. The syrup is often added hot to the beater to give the air cells in the egg albumen an opportunity to develop from the very start of the whipping. If the syrup is thick, heavy and cold, the volume of the batch will be materially reduced. The syrup must not, however, be heated to a temperature that

will coagulate the egg white. The machine used for beating the egg white batch should be of the proper speed and design to provide air circulation; a machine equipped with whipping action is preferable to one that employs a beating action. The quality of egg white, the whipping ability of the machine and the quantity of syrup to be used determine the amount of egg white that should be used in a formula. When egg white or albumen is whipped into a syrup, the egg takes up moisture as the air cells form, causing the batch to become stiffer as the whipping progresses. It is important that a definite balance exist between egg, syrup, moisture and cooking temperature, in order to produce uniform results.

MARSHMALLOW CREAM

To make a firm, consistent marshmallow cream, 100 pounds of corn syrup, 9 pounds of water and 3 pounds of powdered, fresh egg whites are used. The syrup is cooked to 240° F.; the body of this cream may be increased by the addition of a slurry of one pound of tapioca flour in 2 pounds of water to the sugar syrup after it has been boiled to 240° F. The marshmallow cream is made by adding the corn syrup solution to the egg whites dissolved in the water. After developing the volume, stability and texture that comes closest to expectations, cane sugar, invert sugar or cerelose may be substituted for corn syrup, pound for pound as given in the above formula. If further increase of the body of the marshmallow cream is desired, the addition of tapioca solution may be increased.

When powdered egg white is allowed to soak in water for some reason or another, it will deteriorate at room temperature just as rapidly as though it were fresh egg albumen. Therefore, it is quite important to be careful in this respect in order to avoid an unpleasant odor and taste. To make a rapid solution of powdered egg white, equal parts of water and whites are handwhipped until smooth and creamy. The balance of the required water is then added. This procedure may also be employed if an upright vertical type of machine is used, by using the low speed on the machine. Beaten egg whites can also be made from two to four pounds of cold corn syrup for each pound of powdered egg whites. The mixture is creamed at low speed for about one minute until completely dispersed; a required amount of water is added and the mixture whipped up at high speed to a good body consistency, after which the cooked syrup is added slowly, continuing the whipping to a sharp peak. The powdered egg whites are added dry to the (four pounds) cold corn syrup.

When a horizontal type beater is used, part or all of the syrup is placed in the beater. The machine is stopped and the dry, powdered egg whites are added directly to the syrup along the backside of the beater. Any lids or covers are then closed and the machine is started; it is heated for

half a minute and the water slowly added; the beating is continued to a sharp peak. The egg white albumen must not be allowed to come in contact with copper, iron or grease, before or after dissolving it in water.

NOUGAT CREAM AND MARSHMALLOW TOPPING

In making nougat cream, marshmallow topping, or other aerated confections, we are confronted with the delicate problem of creating tiny air cells, by the use of egg white or albumen, generally in the presence of cooked corn syrup, sugar, and other ingredients that go into the finished batch.

Unless a chemical change takes place in the egg white, the air cells will collapse and cause the batch to break down and become soupy. The heat of the syrup appears to be the most important factor in inducing the chemical reaction necessary to stabilize the air cells. As a general rule, temperatures of 160 to 170° F. in the batch will be found the ideal point at which to add the egg white and start whipping or beating. Under some conditions even higher temperatures will be found advantageous, depending entirely on the type of beater and methods employed. Obviously, temperatures above 140° F. will coagulate the egg white (albumen) but whether coagulation or chemical reaction or both stabilizes the air cells, is not definitely known. However, aside from the advantages of high temperatures in proper stabilization of the egg, it is not possible to build up an air cell structure in the presence of cold, heavy syrup, due to the high viscosity of the syrup which prevents the formation of air cells. The viscosity of the syrup must be low enough to permit free development of the air cells.

If the egg white is permitted to coagulate before the air cells are created, the albumen is rendered inert and will not form suitable cells. For this reason care must be exercised in adding the egg white (dry or in solution) to the batch and the temperature of the syrup must be regulated (by whipping) to bring about proper stabilization and viscosity at the finish of the whipping process, which must be timed.

There are several ways of incorporating powdered egg whites (albumen) in the batch. Each method offers definite advantages, depending on the type of beater or production system employed. A brief outline of various methods that may be used follows:

UPRIGHT TYPE VERTICAL BEATER

The powdered egg white is added to an equal amount of water (by weight) and the mixture is creamed at low speed until the egg is thoroughly dissolved (requiring 1 to 2 minutes). As soon as a smooth pasty mass forms, the balance of the water specified in the formula for dissolv-

ing the egg is added and the whipping continued at high speed to a good peak. The cooked syrup (at 170° to 200° F.) is added slowly and the desired consistency achieved by continued whipping.

Another very efficient method is to place two or three pounds of cold or warm corn or invert syrup, to each pound of powdered egg whites, in the bowl of the beater and add the dry powdered egg. The mixture is creamed at low speed for about one minute until the egg is dissolved and a smooth, creamy mass forms. The water specified in the formula for dissolving the egg white is then added and the whipping continued at high speed to a good peak. The cooked syrup (at 170° to 200° F.) is added and whipping continued to the desired consistency.

Reconstituting Dry Whole Egg, Dry Egg Yolk and Dry Egg Albumen to the Natural State

1 lb. of dry whole egg is equivalent to 4 lbs. liquid egg
1 lb. of dry egg yolk is equivalent to 2½ lbs. of liquid egg yolk
1 lb. of dry egg white is equivalent to 8 lbs. of liquid egg white

Whole egg contains 27.80% solids	pH 7.20
Egg yolk contains 43% solids	pH 6.50
Liquid egg white contains 11.85% solids	pH 8.62

USE OF GLYCERINE IN FOOD PRODUCTS

The use of glycerine in food products has long been a common practise, principally as a moistening or hygroscopic agent. However, in addition to its value as a hygroscopic agent, glycerine is sometimes used for its sweetening action. That glycerine is a normal product of the fermentation of sugars has long been recognized. While fermented beverages should not be classed as foods, it should be recalled that bread, our most widely used food, is raised by fermentation and, consequently, contains some glycerine. In addition to the glycerine normally ingested in manufactured products such as beverages, flavoring extracts and bread, glycerine, in combination with fatty acids, constitutes 10–12% of all fats and oils used as food.

There is no objection to the use of small quantities of glycerine in food products, provided it is of a purity suitable for food use and provided that its presence is plainly declared in the labeling when it is not a normal ingredient of the article. It should, of course, not be used to conceal damage or inferiority. In the case of some products (e.g., vanilla extract), glycerin is regarded as a normal ingredient and it is unnecessary to label it.

CHAPTER III

MILK PRODUCTS, CHEESE

Milk, when examined under a microscope, is seen as a transparent fluid which consists of a great number of minute fat globules suspended, together with casein (milk protein) in a solution of albumin (another protein), sugar and water (the fat globules in an average drop, may number more than one hundred million).

COW'S MILK

Cow's milk is a white, opaque liquid having a butter-like odor and a bland, sweet taste; it has a specific gravity of about 1.030. On standing, a yellowish stratum of cream rises to the top, which may run 2–7% of the total milk. Milk in its raw state contains all the vitamins of present knowledge, the exact content being dependent upon the food consumed by the herd. The chemical composition of cow's milk varies: the water content may be 84% to 90%; the total solids average 10 to 16%, including from 2 to 7% fat, 2½ to 4½% casein, 2 to 6% lactose or milk sugar, a small percentage of albumin, a large content of calcium, and a small quantity of other minerals.

Butter is the fat extracted from milk. Casein, one of the chief components, is used in the manufacture of cheese. The milk sugar, or lactose, is a disaccheride and does not have a sweet taste. The normal bacteria content in milk consists of lactic acid bacteria. They cause the souring of milk and are essential to the manufacture of all true cheese.

Certified milk is raw milk produced under very strict regulations specified by the medical milk commissions. The consumer is assured of milk from clean, healthy cows and produced in clean, well ventilated stables. This milk is promptly cooled, bottled and delivered, in the most modern sanitary manner, and with the greatest possible expedition. This milk must also comply with a specified content of fat and other milk solids, and must test favorably for a certain number of bacteria per cubic centimeter.

Pasteurized milk is milk that has been heated, below the boiling point, for a length of time sufficient to kill, or at least to render harmless, practically all pathogenic bacteria. It is then immediately cooled to 50° or lower, to retard the development of any remaining organisms. The chem-

ical change that takes place during this procedure is so slight as to be negligible. The advantages of pasteurized milk are that disease carrying bacteria, that may have entered the milk from the cow or otherwise, are killed, and that it remains fresh much longer than the raw milk. If dairy pasteurized milk is not obtainable, pasteurization can be accomplished by heating the milk in sealed bottles or other containers at a temperature of not less than 145° nor more than 150°, for 20 to 30 minutes, then cooled as rapidly as possible (without breaking the container). It is then kept in a refrigerator or other cool place until used. The next best simple method of pasteurization is boiling the milk for a few minutes, then rapidly cooling it, straining if necessary to remove clumps, and then keeping it in a cool place.

Sterilized milk is milk that has been heated to the temperature of boiling water, or a little higher, and maintained at that point long enough to kill all organisms present. The term is also applied to milk that has been repeatedly pasteurized. These two methods rid the milk of the danger of being a disease carrier, provided, however, that it is not subject to future contamination. Milk prepared this way is objectionable to many people, because of the cooked flavor developed and the destruction of most, or all, of its Vitamin C content.

Dry, or dessicated, milk is a white powder obtained by the evaporation of wholly, partially, or completely skimmed milk. This product is largely used by bakers, chocolate manufacturers, ice cream companies, in baby food and for many other useful purposes. Dry whole milk, which is a soft cream color, averages about 28% fat, while the dry skimmed milk, a white or a light yellowish powder, usually contains an average of ½% fat. Whole milk powder, or skimmed milk powder, lends itself readily to enrichment of the diet by addition to bread, biscuit dough, soups, etc. Whole milk powder is reconstituted by adding one pound of the dry milk to 3¾ quarts of water; skimmed milk is reconstituted by adding 14 ounces of dry skimmed milk powder to 3 13/16 quarts of water.

ACIDOPHILUS MILK

The manufacture of pure acidophilus milk requires the greatest care, both in the preparation of the milk before inoculation and throughout the entire process of manufacture. It must be remembered that L. acidophilus is not a natural inhabitant of milk and must be acclimated to this medium. Even though it be acclimated to milk, its growth is nevertheless such that it is unable to overcome a slight contamination. Laboratory facilities, close supervision, and adequate equipment are essential to the successful production of acidophilus milk.

The first step in the manufacture of acidophilus milk is to obtain

from a reliable source a pure culture of the bacterium Lactobacillus acidophilus of proved therapeutic value. After a pure culture is obtained it must be kept pure as a starter. All chances of contamination must be avoided. Florence or Erlenmeyer flasks are the most suitable containers in which to carry the starter. The flasks should be about half filled with fresh skim milk and plugged with cotton. They are then sterilized in an autoclave at 15 pounds pressure for 20 minutes. The milk after sterilization has a slightly caramelized appearance. After the milk has cooled, a flame from a gas burner should be passed over and around the mouth of the flask and the culture introduced into the flask after the mouth of the culture tube is passed through the flame. The cotton plug from the flask should be held in the hand during this operation and replaced in the mouth of the flask immediately after inoculation. The inoculated milk is incubated at 98° to 100° F. until the milk has curdled. A starter should show a small quantity of whey on top of the curd which should appear firm with no evidence of gas. The curd is broken up by rotating the flask vigorously. The starter should be of a creamy consistency and possess a clean acid flavor and a characteristic aroma. This starter, or mother starter, is carried on by daily transfers from flask to flask. The same procedure as described above is followed except that usually the first bit poured over the lip of the flask is discarded as it serves to wash off the lip. The care necessary to maintain a pure starter of L. acidophilus cannot be overemphasized. The starter should be examined frequently for purity either microscopically or by plates. Should it develop a bad flavor or odor, it must be discarded and a new culture obtained. In any case it is advisable to get a new culture at regular intervals. Kopeloff advises the use of a new fecal culture every two to four months to assure the therapeutic value of the product.

The bulk starter, which is the starter to be used to inoculate the batch, is prepared in the same way as the mother starter; and the same precautions against contamination must be observed. Florence or Erlenmeyer flasks of 2-liter capacity or larger are most satisfactory in which to prepare this bulk starter. These flasks permit the autoclaving of the milk and are most easily handled under the conditions necessary to prevent contamination. The starter should 18 to 24 hours old when used to inoculate the batch and should possess all the qualities indicating purity previously mentioned for the mother starter.

Equally as great care must be exercised in the treatment of the milk as in the preparation of the starter. Only fresh milk of the best quality should be used in the manufacture of acidophilus milk. Whole milk, milk which is partly skimmed, or skim milk may be used. The pasteurizer employed in the preparation of the product must be so fitted

that the milk may be heated and cooled without removing it from the vat, which should be equipped with an efficient mechanical stirrer. The vat must be used not only as a pasteurizer but also as an incubator for the milk. The characteristics of the bacterium Lactobacillus acidophilus make it necessary that the bacteria in the milk be killed before the starter is added. The milk is heated to about 205° F. for an hour and a half or longer and then cooled to 98°. It should have a slightly caramelized appearance after heating; however, this in itself is not an indication that the necessary destruction of the bacteria has been accomplished. Bass recommends heating the milk to 190° to 195° for one hour; then cooling it to 98°, at which temperature it is held for three or four hours; again heating it to 190° to 195° for one hour; then cooling it to 98°; and inoculating. After the milk has been cooled to 98° to 100° it is inoculated with about 2% of the bulk starter. The greatest care must be observed in the inoculating process to prevent the contamination of the batch. The mouths of the flasks should be passed through a flame before pouring the starter. The cover of the vat is lifted just sufficiently to permit the pouring of the starter and is replaced immediately. After inoculation the milk is stirred for a few minutes to distribute the inoculum, and the batch is then allowed to incubate. The temperature of incubation, 98° to 100°, should be maintained throughout the entire incubation period. The batch is incubated until a firm curd has been formed, which usually requires about 18 to 24 hours. The length of the incubation period is dependent upon the size of the inoculation, the temperature of incubation, and the activity of the starter. After the milk has curdled it is broken up by stirring, cooled to room temperature, and bottled.

KEFIR

The yeast is prepared by adding a half teaspoonful of sugar to a 6-ounce or 8-ounce bottle of boiled and cooled water. Half a yeast cake is added to this sugar solution and set in a warm place overnight. This will give an active culture of the yeast and obviate the necessity for adding the yeast cake directly to the milk. This yeast culture should be ready at the time the buttermilk is received or, if made at home, at the time it is curdled.

One to one and a half percent of sugar is added to the buttermilk. On the quantity of sugar added to the buttermilk will depend the extent of the alcoholic fermentation. Theoretically about one-half of fermented sugar may be converted into alcohol; that is, milk to which 1% of cane sugar has been added may contain after the fermentation 0.5% of alcohol. The quantity of sugar added should be governed by the amount of

carbon dioxide it is desired to have in the finished product. This should be sufficient to make the kefir distinctly effervescent and impart to it the peculiar, sharp taste of charged water, but should not be developed enough to blow the fluid out of the bottles when the stoppers are removed. Experience shows that 1% to 1.5% of sugar will give the proper amount of gas. This may be approximated by adding sugar in the proportion of 2 even teaspoonfuls of sugar to each pint of milk. When the buttermilk and the yeast culture are ready, the sugar is dissolved in the buttermilk.

The yeast culture is added to the buttermilk in the proportion of 1 teaspoonful to 1 quart of buttermilk.

The buttermilk is mixed thoroughly and bottled. The bottles should be very strong, as sufficient gas pressure is sometimes generated to break ordinary bottles. The heavy bottles used for ginger ale or other carbonated drinks answer this purpose very well. They should be carefully cleaned and boiled or steamed before being filled and then stoppered tightly. The stoppers should be wired or tied securely in place.

The product is put in a cool place to ferment. If the fermentation is too active the kefir will have a yeasty taste, and the curd is likely to become lumpy and filled with large gas bubbles. A temperature of 18° to 21° C. (65° to 70° F.) will be found satisfactory for kefir which is to be used on the third or fourth day. The floor of a cool cellar is a convenient place to ferment kefir made in the home. The bottles should be shaken as often as may be necessary to keep the curd in a finely divided condition. The finished product should be smooth and creamy, effervesce rapidly when poured from the bottle, and have the pleasant, acid taste of buttermilk, with the added sharpness caused by the gas and the trace of alcohol. Kefir 2 or 3 days old may have a yeasty taste, but if it has been properly made this will disappear as the fermentation of the sugar nears completion; made under these conditions, it should be used when 3 to 5 days old, but if put on ice it may be held for a week or even longer.

DETERMINING THE VITALITY OF LACTIC CULTURES

Cultures used for cheese making or cultured milk produce acid at different rates. The following formula is used to determine the vitality of lactic cultures. A pint of milk is placed in a sterile ground stoppered bottle and heated to 100° F. Then 5 cubic centimeters of the lactic culture is added and 30 minutes later 1 cubic centimeter of rennet is added. One hour after adding the rennet the curd is cut and 2 hours after cutting the curd the whey is drained off. At periods of 2 and 3 hours

after draining the whey acid tests are made on the whey surrounding the curd. A "slow" culture will produce whey titrating 0.16 and 0.23 while an active culture will produce whey titrating 0.42 and 0.63% of acid at the two consecutive titrations. The titrations are made with tenth normal sodium hydroxide using phenolphthalein as an indicator. The result is expressed as lactic acid.

WHIPPED CREAM STABILIZER

Granulated Sugar	27 oz.	Agar-agar	1 oz.
Corn Starch	8 oz.	Salt	½ oz.
Gelatin	1 oz.	Vanilla flavor	If desired

The above ingredients are well blended, added slowly to 4 pints of boiling water, and cooked to 190° F. The mixture is cooled to room temperature until it forms a paste. One gallon of chilled cream (45° F.–fat 38%) is then whipped at second speed until it holds the marks of the beater. One pint of the above paste is added to the cream and the mixture heated for ½ to 1 minute. This whipped cream will not weep, and will hold its shape.

CREMO IMITATION WHIPPED CREAM

Made Without Cream for Filling and Covering Cakes, Filling Sandwich Sponge Cookies and Small Sponge Cakes.

Small Batch		*Large Batch*
2½ pounds	Shortening (Preferably half butter and part plastic coconut fat)	25 pounds
1½ pounds	Sugar (icing)	15 pounds
2 pounds	Nulomoline	20 pounds
3¼ pounds	Milk (evaporated basis)	32½ pounds
¾ pound	Prepared marshmallow flavor (See formula above)	
As desired	Flavor (vanilla)	As desired

The fats are creamed until thoroughly mixed and slightly lightened. The powdered sugar and nulomoline are added and the mixture whipped lightly. During the whipping, the evaporated milk is added gradually. Just before the whipping is finished, the prepared marshmallow flavor is whipped in.

For Banana Fillings: about four ounces of Nulco Meloban for each ten pound batch are incorporated in any convenient way, preferably being first blended with about an equal weight of sugar.

MILK ARTIFICIAL

Sugar	40 g.	Dexterin	20 g.
Soya Bean Powder	125 g.	Egg Yolk, Liquid	50 g.
Lactose	30 g.	Calcium Lactate	6 g.
Peanut Oil	20 g.	Salt	2 g.

Stir in water before use.

SOYA MILK

If the dried beans, preferably yellow-seeded varieties, are soaked for a few hours, then finely crushed and boiled for about 30 minutes in the proportion of 3 parts of water to 1 part of mash, a milky emulsion is obtained which is very similar in appearance and properties to animal milk. This liquid, separated out by means of a very fine sieve or cloth strainer, is the Soya Bean or vegetable milk used so extensively in China. Soya bean meal after the oil is extracted or whole soya bean meal may be utilized quite as well as the whole bean. In the absence of animal milk, soya bean milk is used extensively in the fresh state and as the basis of various kinds of vegetable cheeses in oriental countries. Soya bean milk in the form of a powder is a commercial product in some European countries, and in parts of the United States it has been used in special feeding cases. The milk can be used successfully in numerous preparations, such as breads and cakes, in creaming vegetables, in milk chocolate, and in custards.

After separating the liquid from the solid material, the residue is still very rich in nutritive substances and can be dried and used for cattle feed or made into flour for human food.

SOYA CURD

The addition of magnesium or calcium salts or of rennet or lactic acid to soya bean milk when hot precipitates some of the protein, forming a grayish white curd which settles out, leaving a yellowish water liquid. This curd, after being drained and pressed, represents bean curd of tofu, which is extensively eaten and forms the basis of numerous fermented, smoked, and dried cheeses in China and Japan. Bean curd is made fresh daily and is a staple article of diet among oriental peoples. In many cities of the United States having a large oriental population fresh bean curd may be found in the Chinese and Japanese markets.

COCOA MILK MIX

Cocoa	1.75 lb.	Vanillin	0.003 lb.
Cane Sugar	7 lb.	Salt	0.025 lb.
Agar, Powdered	0.14 lb.		

Mix the above ingredients well and add to each gallon of milk in the pasteurizer at 185° F. Agitate ½ hour.

COCOA MALT POWDER

Cocoa Powder	23 lb.	Sodium Bicarbonate	2 oz.
Fine Granulated Sugar	70 lb.	Salt	8 oz.
Malt Powder, Mild Flavor	20 lb.	Vanillin	½ oz.
Skim Milk (Soluble)	14 lb.	Vanilla Extract	½ oz.

Mix ingredients thoroughly and pass through a coarse sieve. This mixture can be packaged in cans, glass containers, or in 1¼-ounce envelopes for individual use.

STABILIZED CHOCOLATE MILK
Pat. No. 1,989,758

In carrying out the process of making the milk starch emulsion, the chocolate, sugars (when the latter are used), starch, and the gum may be introduced, as dry substances, into the milk, thoroughly mixed, and the mixture heated to a temperature of 170° to 200° F., or higher if desired—although this is not necessary—in place of temperatures approximating 240° F. heretofore recommended, for periods from 20 to 30 minutes, more or less. Preferably, however, a syrup is first made of the chocolate and sugar, and this syrup, together with a preformed mixture, in proper proportions, of the starch and gum, added to the milk and the final mixture agitated and heated as described.

As a matter of convenience to the beverage manufacturer, and in order to insure correct proportions between starch and gum, the starch and gum may be compounded together and the compound delivered to the beverage manufacturer.

In making the compound the agar-agar, for example, is preferably ground dry and screened to the same degree of fineness as the starch and is then thoroughly mixed with the starch in the proportions indicated by the specific examples given below. In such a mixture the agar-agar, although very small in quantity, approximately from 1 to 20 parts of agar to 100 parts of starch, will remain evenly distributed in the starch. It will not sift out. This novel mixture will disperse in the chocolate vehicle much more easily than if the ingredients were introduced into the liquid as separate substances. If the agar is not finely ground it will swell instead of dissolving, particularly at the low temperatures preferably used in compounding, with consequent loss of stabilizing power.

The following examples of typical mixtures, with preferred percentages of the ingredients, will serve to illustrate the character of the present invention. The percentages are by weight.

Formula No. 1

Milk	90.48
Cane Sugar	4.82
Dextrose (Cerelose)	2.41
Cocoa (High Grade, Dark)	1.27
Raw Tapioca Starch (Scott Test 150)	1
Agar-Agar	0.02

Any suitable sugars may be used in the suspension or in the dry product or the sugar ingredient may be omitted if desired. The amount of the sugar ingredient may be varied to any extent. For any usable quantity the sugar does not add to the viscosity of the beverage. The amount of cocoa or chocolate may also be varied. The matter of taste or of economy will govern any increase or decrease. As much as 2.5% of cocoa may be used without changing the percentage of starch or gum. The starch ingredient may be increased to 2 or 3%. Experience goes to show that 1% is near the critical lower limit. More than 2 or 3% gives too high a viscosity and is likely to give a distinct starch taste to the product. The agar-agar may be varied in amount from about 0.01 to 0.2%, but at the upper limit there is a strong tendency to segregation in jelly-like lumps.

Formula No. 2

Milk	90.78
Cane Sugar	4.07
Cerelose	2.03
Cocoa (Cheaper Quality Than in No. 1)	1.673
Raw Corn Starch (Scott Test 100)	1.433
Gum	0.024

The first four items may be varied as indicated in No. 1.

The same quantity of modified corn starch may be used in place of the specified raw corn starch. The amount of corn starch may vary between 1 and 2%. Where raw corn starch is used the lower limit of the gum quantity should not be quite as low as in No. 1.

Formula No. 3

Milk	91
Cane Sugar	4.01
Cerelose (Corn Sugar)	2.03
Cocoa	1.676
Wheat Starch (Scott Test 85)	1.2
Gum	0.024

The variations may be substantially the same as with No. 1.

The time of cooking with the raw corn starch should be ordinarily 25

to 30 minutes; with the modified corn starch 20 to 25 minutes; with the tapioca and wheat starches about 20 minutes.

COCOA MILK

In this improved formula use

Cocoa	20 lb.
Sugar	90 lb.
Skim Milk	90 lb.

To the above syrup add 2000 pounds of milk; heat to 143½° F. and hold for 30 minutes. Homogenize the mixture at 2000 to 3000 pounds pressure while hot.

Cool and bottle.

COCOA MILK NON SETTLING

Cocoa Powder	6 oz.
Sugar	28 oz.
Sodium Alginate	1 oz.
Milk	15 qt.

Mix together the cocoa, alginate, and sugar. Heat the milk to 160° F., add the dry mixture slowly with constant stirring, for 30 mintues. Cool the batch to 45° F. and hold for 2 hours before bottling in sterilized bottles. The cocoa powder can be of any fat percentage from 10 to 25%. The milk can be either whole milk or skim milk, or any mixture of each. Additional flavoring ingredients such as vanilla, malt, caramel, etc., may be added.

CREAM AID

A preparation to aid in whipping cream.

Lime water and sugar, or a saturated solution of calcium saccharate.

Direction: 1 teaspoonful Whippit to the pint of cream.

CREAM IMPROVER

1.	Water	7 pt.	Mix sugar and agar, and boil up with water for 3 minutes.
	Sugar	3 lb.	
	Agar	1 oz.	
2.	Water	1 pt.	Cook this a day ahead and add to above. Mix and bring to boil.
	Corn starch	4 oz.	

3. Cream the above cold mix in the beater. Then add 1 lb. meringue powder and beat until fluffy.

The addition of this finished mix, in the proportion of 1 gallon to 3 gallons of whipped cream, results in a product superior to that mixed

with straight meringue. The cream should be whipped up first and then incorporated with the above improver.

CREAM TABLES

Table for Mixing Cream and Milk to Obtain 100 Pounds of 20% Cream

When Cream Shows Butter Fat to be	Take		Take	
	Cream, lb.	Skim Milk, lb.	Cream, lb.	4% Milk, lb.
21%	95	5	94	6
22%	91	9	89	11
23%	87	13	85	15
24%	83	17	80	20
25%	80	20	76	24
26%	77	23	73	27
27%	75	25	70	30
28%	72	28	67	33
29%	69	31	64	36
30%	67	33	62	38
35%	57	43	52	48
40%	50	50	45	55

TABLE TO REDUCE 100 POUNDS OF CREAM TO 20%

To 100 Lbs. Cream Showing	Add		To 100 Lbs. Cream Showing	Add	
	Skim Milk, lb.	4% Milk, lb.		Skim Milk, lb.	4% Milk, lb.
40%	100	125	26%	30	37½
35%	75	93¾	25%	25	31¼
30%	50	62½	24%	20	25
29%	45	56¼	23%	15	18¾
28%	40	50	22%	10	12½
27%	35	43¾	21%	5	6¼

1 gal. 30% Cream weighs 8.3 lb. 1 gal. 40% Cream weighs 8.2 lb.

QUANTITY TO BE TAKEN FROM CREAM AND SKIM MILK TO MAKE 100 POUNDS CREAM TESTING

CREAM SHOWS PER CENT FAT	8%	10%	12%	14%	16%	18%	20%
16	50.0	62.5	75.0	87.5	100.0		
17	47.0	58.8	70.9	82.3	94.0		
18	44.4	55.5	66.6	77.7	88.8	100	
19	42.1	52.1	63.1	73.6	84.2	94.7	
20	40.0	50.0	60.0	70.0	80.0	90.0	
21	38.0	47.5	57.1	66.6	76.1	85.7	95.2
22	36.3	45.4	54.5	63.6	72.7	81.8	91.9
23	34.7	43.4	52.1	60.8	69.5	78.2	86.9
24	33.3	41.6	50.0	58.3	66.6	75.0	83.3
25	32.0	40.0	48.0	56.0	64.0	72.0	80.0
26	30.7	38.4	46.1	53.8	61.5	69.2	76.9
27	29.6	37.0	44.4	51.8	59.2	66.6	74.0
28	28.5	35.7	42.9	50.0	57.1	64.3	71.5
29	27.5	34.3	41.3	48.2	55.1	62.0	68.7
30	26.6	33.3	40.0	46.6	53.3	60.0	66.6
31	25.8	32.3	38.7	43.7	51.6	58.0	64.5
32	25.0	31.2	37.5	42.4	50.0	56.2	62.5
33	24.2	30.3	36.3	41.1	48.4	54.5	60.6
34	23.4	29.4	35.2	45.1	46.8	52.9	58.8
35	22.8	28.5	34.2	40.0	45.7	51.4	57.1
40	20.0	25.0	30.0	35.0	40.0	45.0	50.0
45	17.7	22.2	26.6	31.1	35.5	40.0	44.4
50	16.0	20.0	24.0	28.0	32.0	36.0	40.0

The figures 8, 10, 12, 14, 16, 18, 20 represent the per cent of butter fat desired.

The other figures represent the pounds of cream to be taken, and this number subtracted from 100 gives the pounds of skim milk required.

EXAMPLE Cream on hand shows 26% Fat.
Cream to be made shall show 20% Fat.

Find 26% in the left hand column and follow the horizontal line to 20% and you come to the number 76.9.

You must take 76.9 pounds of your 26% and add to it 23.1 pounds of Skim Milk to make 100 pounds 20% Cream

$$\begin{array}{r} 100 \\ -\ 76.9 \\ \hline 23.1 \end{array}$$

CHEESE

Cheese is essentially a processed form of casein, or milk protein, which also contains butter fat. The milk is generally acidified by the addition of lactic acid bacteria and the curd or casein coagulated by a soluble ferment called "rennet." It is then separated from the whey, the latter consisting of water, milk, sugar, a little fat and minerals. One part of rennet may coagulate as much as 250 thousand parts of milk. Before the rennet is added the milk may be tested for ripeness for curdling. For this test, a teaspoonful of diluted rennet extract is added to four ounces of milk and, if the coagulation takes place within 45 to 60 seconds, the milk is ready for the addition of rennet. Sour milk cheeses such as cottage, cream, Neufchatel, Gervais, and buttermilk owe their flavors chiefly to the lactic acid produced by the lactic acid bacteria. The characteristic flavors of other varieties of cheese are developed largely during later processing. These flavors are due to exposure of the cheese to bacteria, molds, or yeasts that occur naturally or are added. The striking differences in the flavor and consistency of cheeses may also be due to the type of milk used, e.g., whole milk, skimmed milk, cream, or a combination of milks; the milk may be derived from cows, goats, sheep or be a mixture of these. The time spent in ripening and aging the cheese determines the definite characteristics, e.g., for Cheddar types (ordinary American or store cheese) the lactic acid bacteria are permitted to develop in great numbers before the rennet is added, whereas in Swiss, Camembert or Limburger cheese, they are not. Also, in Cheddar, the moisture content (whey) left in the curd is considerably less than that present in Camembert; this means that more fermentable milk sugar is present in Camembert. Emmenthaler (Swiss) curd is cooked much longer, and at a higher temperature, than Cheddar, and Camembert curd is not cooked at all. The amount of salt added to cheeses, whether it is incorporated before or after pressing, the difference in temperature during ripening and intensification of the activity of bacteria (e.g., in Roquefort cheese), all vary for different cheeses.

Great skill, acquired only after long practice based on years of experience, is required for the regularly repeated production of a specific flavor and consistency. These depend, not on one but several, forms of minute microscopic life. For example, in Camembert, the chief biological factors are lactic acid bacteria, the ever present milk mold, and a foreign Penicillium mold, the blue-green bread mold. If the lactic acid bacteria are permitted to develop in too great numbers, before the curdling, the consistency of true Camembert cannot be attained. If the Penicillium over-

crowds the milk mold, the consistancy may be good, but the flavor is inferior.

Cheeses are commonly graded as special, fancy, good, prime and common. The terms used to denote size and weight are fanciful expressions such as "Young America" for small cheese of nine to eleven pounds, and "Long Horn," "Daisy," etc., for larger specimens.

Whole milk, or full cream, cheese is made of milk from which no portion of the fat has been removed. Cream cheese is made from milk and cream by a special process.

COMPOSITION OF MILK, MILK PRODUCTS AND BUTTER

Kind	Water %	Butter-fat: %	Protein: (Casein and Albumin) %	Milk Sugar: %	Minerals: %	Total Milk Solids: %
Liquid Whole Milk	88	3½	3¼	4½	¾	12
Evaporated Whole Milk	72	8	7¾	10½	1¾	28
Sweetened Condensed Milk	31	.8	7¾	10½	1¾	28
(Cane Sugar)	....	41				
Powdered Whole Milk	1½	27½	27	38	6	98½
Liquid Skimmed Milk	91		3½	4¾	¾	9
Skimmed Sweetened Condensed Milk (Cane Sugar)	29	43	11	14½	2½	28
Powdered Skimmed Milk	2½	1½	38	50	8	97½
Liquid 18% Cream	75	18	2½	4	½	25
Powdered Cream	½	72	10½	14½	2½	99½
Butter from Fresh Cream	13.03	83.75	0.64	0.35	0.14 2.09 Salt	
Butter from Ripened Cream	13.78	82.97	0.84	0.39	0.16 1.86 Salt	

American Cheese Also known as American Cheddar or Store Cheese	Made from sweet milk, whole or skimmed, in large molds, weighing from 10 to 60 pounds, and of varying shades of yellow or uncolored. Originally made in Cheddar, England, but now imitated in the U. S. A. Many varieties of packaged cheese are made from it.
Brick Bat	An English cheese made from new milk and pressed into a brick-like form.

Brie Cheese	A richly salted cream cheese, made in Brie, France.
Camembert Cheese	A finely flavored cream cheese of a pale yellow color, made in France. Usually put up in small round wooden boxes and in round tins.
Cottage Cheese, Clabber Cheese, Dutch Cheese, Pot Cheese, Smeerkaas	A pressed curd, into which cream is added, without rennet. Cottage cheese of the best texture; contains 70 to 75% of water.
Cream Cheese	A soft cheese made from unskimmed milk, with or without the addition of cream. The name does not imply that the cheese is made from cream.
Dunlop Cheese	A soft cheese similar to single Gloucester, made in Ayrshire, Scotland.
Dutch Cheese	a. A hard cheese made from skimmed milk pressed into round molds, the outside being colored a reddish tint with a preparation of madder. b. The same as cottage cheese.
Edam Cheese	A hard mild cheese made in Holland. Molded in round forms and usually coated with a dark red color or with paraffin. Each cheese weighs from 3 to 4 pounds. Packed 12 pieces to the case.
Filled Cheese	A kind of cheese made from skim milk, so called because a fatty filling such as lard or oleomargarine is used as a substitute for the cream.
Gloucester Cheese	A rich English cheese of mild flavor. It is called single or double Gloucester, depending on the amount of cream in its composition.
Gorgonzola Cheese	Is a rennet cheese made from fresh whole cow's milk in Northern Italy. It takes its name from the village of Gorgonzola, a few miles from Milan, but the manufacture of the cheese has spread over a wide area. At its best, Gorgonzola is very similar to Roquefort.

Gruyère Cheese Schweitzer, Swiss or Emmenthaler Cheese	A cheese made in France and Switzerland, intermediate between hard and soft, yellow, and of an open structure. The characteristic holes of this cheese are caused by gas-producing bacteria during the process of ripening. It is a mild cheese, dry, and of a distinctive, somewhat sweet flavor. A "Domestic Swiss" is made in the U. S. A. but is inferior to the imported cheese.
Limburger Cheese	A soft cheese originally made at Limburg, Belgium, and now in the U. S. A. It is kept until putrefaction begins, hence its strong odor and taste. Put up in 1- and 2-pound bricks. Packed in full cases, weighing about 125 pounds, half and quarter cases.
Lincolnshire Cheese	An English cheese made in small molds from new milk and cream.
Neufchâtel Cheese	A delicate cream cheese made in small molds at Neufchâtel, France.
Parmesan Cheese	A hard dry cheese of delicate flavor and colored with saffron. Made in Italy. When broken, it has a granular appearance. Used grated for seasoning macaroni. Long keeping qualities.
Pont l'Evêque Cheese	A cream cheese similar to Neufchâtel cheese.
Primost Cheese	A cheese made from whey and brown sugar, a by-product of American cheese. Put up in 2½-pound pieces. Especially liked by the Scandinavian people.
Roquefort Cheese	A hard cheese made at Roquefort, France, from ewes' milk. When the cheese is almost solid and dry it is placed in caves in which the temperature remains at 40° F. Here the cheese takes on a reddish color and develops the green mold around the bread crumbs used in preparing it.

Sage or Green Cheese	Regular American cheese to which have been added leaves of the sage to impart a green color and give it the sage flavor.
Sap Sago Cheese	A hard skim milk cheese, made in conical molds, weighing about 6 ounces. It contains a powdered herb of the clover type, which gives it its characteristic flavor and green color. The sap sago cheese is used for grating purposes mainly and is especially liked by the German people (Kraeuter-Kaese).
Slipcoat Cheese	A rich cheese made from milk while it still retains its natural warmth. It is soft and resembles uncolored butter.
Stilton Cheese	A double cream cheese of strong taste. Originally made at Stilton, England.

The Government grades of most general interest to the consumer are:

1. U. S. Extra Fancy	Score 95 or above
2. U. S. Fancy	Score 92–94
3. U. S. No. 1	

Maximum Score

Body and texture	40
Flavor	30
Finish and appearance	20
Color	10
Total	100

VARIATIONS IN COMPOSITION, AGING, ETC.

Kind	Aging	Approx. Content of			Milk Product Used
		Water	Fat	Protein, Ash	
American Cheddar	Unripened to fully ripened	36%	34%	30%	Whole cow's milk.
American Cheddar	Unripened to fully ripened	57%	5%	38%	Skimmed cow's milk.
Swiss	Ripened	33%	30%	37%	Whole cow's milk.
Cream	Unripened	39%	47%	14%	Cream or enriched cow's milk.
Cottage	Unripened	72%	1%	27%	Sour skimmed cow's milk.
Roquefort	Ripened	38%	32%	30%	Cow's milk.

CHEESE, ICE-CREAM, AND SALAD STABILIZER

U. S. Patent 2,007,218

Locust bean gum	65 oz.
Irish moss, powdered	35 oz.
Karaya gum	15 oz.

When the stabilizer is used in the preparation of cream cheese, it is added at the time the curds are mixed with the cream, following the usual procedure for the manufacture of cream cheese, and in the proportion of about one-half of 1% by weight on a wet basis. The material is heated to about 165° F., homogenized, and then packed hot.

In ice cream, the stabilizer is used diluted with sugar, in the preferred proportion of 0.5%, on a wet basis. The stabilizer acts to prevent crystallization of ice particles and, thus, insures a fine, smooth texture and a body which will hold up under severe shocks, such as are encountered in transportation and handling. The use of it in ice cream usually results in more rapid freezing, especially in old-style freezers.

CHEESE EMULSIFIERS

U. S. Patent 1,940,031

1–4% of any of the following are used: sodium mucate, sodium lactate, disodium phosphate.

PRESERVATION OF RINDLESS CHEESE

British Patent 434,374

Bacterial action on the surface of rindless cheese is prevented by treatment with the following prior to heating to 65° F.:

Hydrogen Peroxide (35%)	0.3%

A cheese low in fat content is first heated to 65° C, the peroxide is then added, the batch is mixed and re-heated to 80° C.

MANUFACTURE OF NEUFCHATEL CREAM CHEESE

Cream cheese is a soft, unripened cheese, usually made from cream testing from 12 to 20% fat, coagulated by the development of acidity or by the use of rennet, and then pressed in cloth bags. The product is creamy white in color, of a fine, smooth texture, and having a full rich cream flavor. The fat content of the cheese varies from 30 to 40%, with a corresponding variation in moisture.

Neufchâtel is a similar cheese, made from either whole milk or cream,

and has a correspondingly lower fat content. The popularity of this and other soft cheeses has grown tremendously in recent years.

THE COMMERCIAL MANUFACTURE OF NEUFCHATEL CHEESE

This cheese, although commonly made from cream testing between 10 and 20% fat, may also be made from milk or cream of any fat content. Cream with a fat content of more than 25% is ordinarily impractical and uneconomical to use. If the fat content of the raw material is approximately equal to that of whole milk, the cheese is commonly called Neufchâtel cheese rather than cream cheese. Care should be taken in selecting the raw material. Milk or cream used in the manufacture of cream cheese should be fresh, sweet, clean, free from all foreign flavors and should contain as low a bacteria count as possible.

The cream is standardized to the desired fat content of 12 to 20%; the higher the fat content, the smoother, richer, and better the keeping quality of the finished cheese. It should be heated to 145° F. and homogenized at 2,000 to 3,000 pounds pressure, for 30 minutes, after which it is cooled to 72° F. and set with 0.10 to 0.25 per cent of starter to give it an acidity of 0.6 to 0.7 per cent, in 14 to 16 hours. The material may be set in shotgun cans, ten-gallon milk cans, or in any vat equipped with an agitating device.

Higher acidities make a sour cheese of poor quality, while lower acidities retard draining and make the body of the finished cheese rubbery or stringy. When the acidity is between 0.6 and 0.7 per cent, the entire mass of curd is agitated and slowly heated to 120° to 125° F., or until definite whey separation is noticeable. The curd is then homogenized at 300 to 500 pounds pressure, cooled to 50° or 60° F., and placed in draining bags (18″ × 36″) of unbleached muslin, or similar material, that will allow free draining of the whey without loss of any curd. This last homogenization may be omitted if plant equipment or routine does not conveniently allow for it.

These bags, each holding about 10 gallons of curd and whey, are stacked in a "cooler" (40° F.), either on a rack or a clean tiled floor, and frequently shifted to facilitate drainage. If the cheese is made in sufficient quantities to allow the bags to be stacked high enough so that they will be pressed by sheer weight, no other arrangement is necessary to press the curd. If, however, the cheese is made in small quantities (as is the case in most instances), a press made from hard-wood slats (1½″ × 1½″) spaced from 2″ to 3″ apart, will serve the purpose (Fig. 4). Under these circumstances it is only necessary to make two trays. The bags of curds are placed between these trays and additional weight,

in the form of 10-gallon milk cans filled with water, is applied. The curd is pressed until it is firm enough to hold its shape; usually 48 hours suffices (from the time the mixture is placed in the bags).

Salt may be added, either at the time the curd is placed in the bags, or after the curd is pressed. If added when the curd is placed in the draining bags, about three times as much salt as is necessary, because more must be added to allow for the salt lost through whey drainage. The amount of salt used in either case depends on personal taste; 1 to 2 per cent is usually sufficient, if added after draining. Cheese of this type is packed in ¼ pound cartons, glass or stone jars, metal foil packages, or in 3 or 5 pound loaves in wooden boxes. Any protection, such as that furnished by a container, a parchment wrapper, or by metal foil, which prevents the air from coming in contact with the surface of the cheese, will materially reduce spoilage. The packaged cheese should be kept as cold as possible without freezing. If properly made and kept under refrigeration, this cheese should keep for at least three weeks.

By adding various flavoring materials such as pimentos, olives, nuts, sweet pickle relish, honey, and similar materials a great many varieties of cheese and cheese spreads may be made. In making pimento cheese, one No. 2½ can to each 15 pounds of curd gives very satisfactory results. Olive nut cheese can be made by mixing 2 pounds of chopped olives and 1 pound of chopped pecans with 15 pounds of curd. Relish cheese is made by mixing 2 pounds of sweet pickle relish with 15 pounds of plain or pimento-flavored curd.

These cheeses find a ready market in most communities and afford an excellent outlet for milk that might otherwise become a burdensome surplus. Opportunities for developing this type of cheese business are practically unlimited and depend only on the ingenuity of the dairyman.

ANOTHER METHOD OF MAKING BAKERS' NEUFCHATEL AND CREAM CHEESES

The starting material may be skimmed milk, whole milk, or whole milk to which has been added the cream from an equal volume of milk. The resulting products will vary in flavor and in texture according to the amount of fat incorporated. Raw milk of good quality may be used, but pasteurizing the milk for 30 minutes at 143° to 145° F., and cooling promptly to 72° F., will tend to insure better cheese.

The starter is added at the rate of 1 teaspoonful to each quart of milk, or ½ pint to each 10 gallon can, or ⅗ pint to each 100 pounds.

Rennet extract, well diluted in cold water, is than added at the rate of 30 drops to each 100 pounds of milk. For small amounts of milk, ¼ of a junket tablet in 6 tablespoons of cold water, may be used (1

tablespoon of this solution to each quart of milk). The milk must be well stirred while the rennet solution is being added.

The milk is allowed to stand undisturbed at 72° F., until the curd is jellylike and firm, and whey just starts to appear at the surface; a period of 12 to 15 hours is usually sufficient for setting.

While not imperative, cooling of the curd is beneficial, and stimulates drainage. This may be accomplished by setting the container in ice water until the temperature of the curd is down to approximately 50° F., gentle stirring of the curd being employed to hasten the cooling. The addition at this time of a heaping tablespoon of salt for each fifteen pounds of milk will also hasten drainage and will retard acid development.

The curd is next dipped (or poured) into muslin draining cloths or bags, and the bags hung in a cool place to allow the curd to drain. If clean, pure ice is available, small pieces may advantageously be added directly to the curd. The cloths must be opened occasionally and the dry curd scraped toward the center, with a large spatula, table knife, or spoon.

The curd is re-tied and drainage continued, until the whey is almost completely expressed. Pressure is applied, gently at first, because the soft curd tends to fill the meshes of cloth and interfere with the passage of whey. One method is to use a pail of water as a weight either on the end of a lever or set directly on a plate or board covering the cheese. The pressure may be readily varied by altering the amount of water in the pail. The drainage is slow at best, and it is advisable to pack the curd bags in crushed ice during the pressing period, to check the development of acid.

Judgment as to when the curd is sufficiently dry comes with experience; the curd should be firm enough to show a clean break like cast iron or steel, and should be fairly resistant to pressure. The average yield is 14 to 16 pounds from each 100 pounds of whole milk, and 18 to 20 pounds from creamed milk.

When the curd has been sufficiently pressed, 1 to 2 pounds of salt to each 100 pounds of curd, or about 1 teaspoon to a pound, are added. The curd may then be smoothed by mixing, or by use of a food chopper or cake mixer. Breaking and remixing the curd after pressing may be avoided by stirring the salt in just before the curd is put to press. This method requires a greater amount of salt (to compensate for that which passes out in the whey), but reduces the labor, and keeps the cheese in cake form as it comes from the press.

MANUFACTURE OF ROQUEFORT CHEESE (FROM GOAT'S MILK)

The original Roquefort cheese process, as perfected in France, employs sheep's milk; in America a similar cheese has been made successfully from cow's milk. Goat's milk, which is the milk used in the procedure that follows, is similar to sheep's milk in color and body, and if manufactured with the usual dairy care, a cheese of excellent quality should result.

In the manufacture of this cheese the methods outlined below may be modified to meet specific conditions.

Fresh clean milk is necessary for making Roquefort cheese; the acidity should be between 0.16 and 0.18 percent for the best results. Over-ripe milk is likely to result in a gassy cheese and, sometimes, in an objectionable flavor. From 3 to 4 per cent of good clean lactic starter (depending on the acidity of the milk and starter) should be added.

For sheep's milk, the temperature of setting used in France is from 76° to 84° F. Cow's milk should be set at 82° to 85° F., and goat's milk at 82° F. When goat's milk is set above this temperature, difficulty is encountered with cracking of the curd, but if 20 per cent of cow's milk is added to the goat's milk this difficulty is overcome. When a combination of cow's and goat's milk is used, it is advisable to set the milk at 84° F. A lower temperature is liable to result in a soft, mushy curd which fails to drain properly, while a higher temperature may result in a tough curd.

The milk is heated in an ordinary cheese vat and stirred to insure even distribution of fat and heat. After the acidity has developed to 0.21 or 0.22 per cent, commercial rennet (diluted from twenty to forty times with pure cold water) is added to the milk, which is then agitated thoroughly.

The setting period should be approximately one and one-half hours, but varies with the acidity, temperature and quality of the milk. Beads of whey (gradually becoming a film of whey) spread over the surface of the curd, indicating that it is ready for cutting. The curd is cut in two directions with a coarse, vertical knife with wires ⅝ in. to 1 in. apart. Soon after this, the curd slowly contracts and draws away from the sides of the vat. This contraction should not be allowed to go too far, however, before dipping the curd.

A cheddar cheese vat similar in capacity to that in which the milk was set, makes an excellent drain vat, if it is provided with a false bottom covered with cheese cloth or muslin of good quality. The two vats should be placed near enough together to permit two or three workers

to do the dipping. Large tin scoops, each with a capacity of three or four quarts, are suitable for this purpose.

The curd should be transferred to the drain vat rapidly and carefully. Two men should be able to take the curd from 1500 pounds of milk in ten to fifteen minutes. Raising the cloths from time to time aids in expelling the whey and in bringing the draining curd to the proper condition of dryness. The time required for draining is twenty to forty minutes, depending on how often the cloths are raised during this period. The curd should be placed in the forms in a fairly moist condition. When it is too dry, the surface of the cheese becomes so open and rough, that undesirable organisms may have access to the interior. Greater losses occur in the curing process when such conditions exist.

The whey should be drawn from the drain vat and run through a whey separator. The average fat loss from goat's milk is 0.50 to 0.60 per cent, while that from cow's milk is 0.20 to 0.30 per cent. When 20 per cent of cow's milk is added to goat's milk, the fat loss is reduced to about 0.40 per cent. It is probable that a satisfactory reduction of loss would be obtained with somewhat less than 20 per cent addition of cow's milk.

The hoops (or forms) for Roquefort cheese are made of galvanized metal with wire edges. They are round and open on both ends, and are 7⅜ inches in diameter and 6 inches high. They have six horizontal rows of holes, each row having 25 holes, ⅛ inch in diameter. The hoops are placed upon special reed mats, 10 by 24 inches, which, in turn, are placed upon boards of approximately the same size, each of which will hold three hoops. (Cloths may be used instead of mats, but they are not so satisfactory.) All hoops, mats, and boards should be thoroughly cleaned and sterilized before using, to reduce the number of foreign molds which may appear later.

When it is put into the hoop, the curd is a white, pulpy mass and should contain only a small excess of whey. The hoop is filled with four or five layers of curd, between which liberal applications of mold powder are sprinkled.

The drain room should have a temperature of 65°-68° F. and a relative humidity of 85-90%, to prevent the cheese from drying out. Higher temperatures favor the development of injurious molds. The cheese is left in the room for about four days. It is turned several times during the first day and twice daily thereafter, the object of the repeated turnings being to hasten drainage and insure a smooth, even surface. The hoops, which are allowed to remain around the cheese for the first one or two days, should be washed and sterilized before using

them again. The boards should be washed every day. The cheese is scraped each day while in the drain room, in order to remove the coating of slime which forms over the surfaces.

The salting room should be dry and have a temperature of approximately 48° F. There should be sufficient ventilation to remove the excess of moisture drawn to the surface of the cheese by the salt. The cheese should be salted two or three times at two-day intervals, depending on the amount of salt desired and the conditions affecting its penetration. The cheese should be placed in the salting room several hours before the first salt is applied, in order to cool it to room temperature. Cheese salt is then rubbed vigorously over the surface, until no more will adhere.

After the cheeses are thus salted, they are piled two or three high, and the following day their positions reversed, with no addition of salt. On the third day they are again salted in the manner previously described. On the fifth day they may receive a light sprinkling of salt, if intended for markets preferring a highly salted cheese. The entire salting period should take from 10 to 14 days, depending on the type of cheese desired.

Some experience is required to salt Roquefort cheese successfully, the usual tendency being to undersalt or oversalt. Cured Roquefort cheese should contain at least 4 per cent salt, an amount which is sufficient to prevent an excessive development of the mold, Oidium lactis. Most of the cheese made in these experiments contained from 5 to 6 per cent, which did not seem to affect the quality for most consumers, although some preferred a less salty cheese.

During the salting process a slimy coat, composed of softened cheese, whey, salt, and micro-organisms, begins to form. This coating is scraped off with an ordinary case knife. Care should be taken not to scrape the cheese too deeply, since, at this period, a high percentage of salt on the surface is essential.

The cheese is punched immediately after the scraping. Oxygen is necessary for the proper growth of the Roquefort mold, and in order to let the air in, each cheese is punched with a needle in twenty to fifty places. The needles are about ⅛ inch in diameter and about 8 inches long. The cheese is placed on edge after the punching in order that the holes may not close, and that the maximum amount of air may come in contact with the mold.

RIPENING OR CURING:

The curing room should have a temperature of 42°-48° F., a relatively high humidity (about 92 per cent) and moderate ventilation.

Conditions Favorable For Curing Goat's Milk Roquefort Cheese

Period	Temperature	Relative humidity	Ventilation
	Degrees F.	Per cent	
First four days	65-68	85-90	Slight
Next ten days	46-48	80-90	Considerable
Third week	42-48	90-95	Moderate
Fourth and fifth weeks	42-48	90-95	Moderate
Second and third months	42-48	90-95	Moderate
Fourth and fifth months	46-48	80-90	Considerable

The humidity and ventilation indicated in the above table cannot be expressed with any great degree of accuracy at the present time. The table shows in a general way, however, the conditions that have proved most successful. With experience, they can be controlled properly.

In the work at the University Farm, well-insulated curing rooms were used. The sides, tops and bottoms were insulated with 4 inches of cork laid in hot asphalt and covered with Portland cement plaster. Direct expansion ammonia refrigeration and brine coils were used in order to maintain the low temperature. A perforated water pipe was placed along the top of the room so that water could trickle down over a screen behind the shelves in order to maintain the proper humidity. Water cooled to room temperature is more economical than tap water, since the cost of refrigeration is lower. A vacuum cleaner motor was installed, and run continuously at low speed, in order to obtain the proper circulation of air. The air was drawn from the curing room and forced back again. Outside air was taken in only when the door was open.

During the first two or three weeks there should be a gradual development of a reddish slime upon the surface of the cheese, together with patches of white and green mold. In cases where the reddish slime fails to develop rapidly, scrapings may be obtained from other cheese. These, mixed with sterile water and then sprinkled on the cheese, give the desired growth without difficulty. This growth should be removed by scraping every three or four weeks in order to permit the air to reach the mold in the interior of the cheese. After this scraping there is only a slight development of the white and green mold, but there is much greater development of reddish slime.

Within ten days after punching, mold can be seen through the punched holes when the cheese is held before an electric light. Within two or three weeks or a month, there is probably as much green mold visible

as when cheese is cut several months later. The mold in the center of the cheese appears to develop more rapidly than that nearer the surface, probably because of the difference in concentration of salt. In the earlier stages of ripening, the cheese often tastes bitter; later this condition disappears and a sweet, piquant flavor is noticeable with little or no bitterness. With the proper curing conditions, the texture of goat's milk Roquefort cheese can be made similar to that of the imported variety. In some cheeses, a typical peppery flavor, repellent to the taste, develops. This is probably due to an intense oxidation (evidenced by the production of formic acid) which occurs when the cheese is held for a long period at a high temperature.

High humidity prevents the cheese from drying and increases the rapidity of growth of the slime on the surface. No experimental data is available to show that the surface growth aids in the ripening of the cheese, but its presence is always associated with the best grades. This slime seems to check the growth of surface mold and to keep the cheese in a sweet, normal condition. Dryness causes the cheese to ripen slowly with a flavor lacking the characteristics of good Roquefort, and a texture which is too waxy.

The cheese may be taken from the curing shelves when about three months old, scraped for the last time, and wrapped in tin foil or aluminum foil. At this time there should be an abundance of mold and some flavor, but as a rule, the full flavor develops only after the cheese has been left in the foil for a few months.

Enclosing the cheese in the foil prevents drying, excessive oxidation, and the escape of the volatile substances. It also helps to develop the sweet flavor, and reduces the formation of strong, biting, and soapy flavors which may occur when cheese is exposed too long to the air. Parchment paper is used to protect the foil. Paraffin cannot be used as a substitute for foil because of the moist condition of the surface of the cheese.

Roquefort cheese made from goat's milk requires from 4 to 7 months to ripen. When ripened it may be placed in cold storage at about 34° F., for eight months to one year, in order that a uniform supply of cheese may be placed on the market throughout the year. During this storage, the cheese should become sweeter and more fragrant.

LOSSES IN CURING:

In Roquefort cheese made from cow's milk, the average loss from scraping, brushing, and handling is 7.4%, which seems to be less than the loss in sheep's milk Roquefort. The losses in goat's milk Roquefort are very small because of the firmness of the cheese.

The loss from shrinkage will vary with the moisture content of the cheese at the time it is wrapped in foil, the temperature, and the time it is kept before shipment. Even under the best conditions, there is some shrinkage, due largely to evaporation and leakage of whey.

YIELD:

Goat's milk with an average butterfat content of 3.4% gives an average yield of 10.34 pounds of cheese for every 100 pounds of milk.

PREPARATION OF MOLD POWDER:

Mold powder for inoculation purposes is grown on ordinary white bread. Stock cultures of Roquefort mold should be obtained from a reliable laboratory several weeks before the manufacture of cheese is contemplated.

The mold powder is prepared as follows: fresh loaves of bread are sterilized by heating in a drying oven for two hours at 170° C. (338° F.), and then cooled to room temperature. Meanwhile, a suspension of mold is made by transferring spores from an agar culture of Roquefort mold, by means of a sterile platinum needle, to a flask of sterile water and shaking.

A sterilized (1 c.c.) pipette is then filled with this suspension and the bread inoculated by allowing a small quantity of the suspension to flow into numerous holes, previously punched with a sterile glass rod or a sterile pipette. At least one ounce of the suspension should be used for each pound of bread, and the punctures must be well distributed to insure an abundant growth of mold in all parts of the loaf. The inoculated bread is put in a moist cold place (48° F.) and left for several weeks to allow the mold to develop to the stage at which it is suitable for use in the cheese. This stage is indicated by the spread of the green mold throughout the bread.

The Roquefort mold develops more vigorously in the cheese and is less likely to be contaminated with foreign molds when grown at a low temperature. When there is evidence of foreign mold in the bread, the infected part should be removed or the entire loaf discarded. Since Roquefort mold grows rapidly at a low temperature in the presence of carbon dioxide gas, foreign molds cause but little trouble in the cheese. This is especially true with Roquefort mold grown in bread at a temperature of 48° F.

When the bread is completely invaded by the mold, it is thoroughly dried and then sliced and ground in a coffee grinder, or with a rolling pin, to a condition in which it is fine enough to pass through a salt shaker. It should be kept in a cool dry place to prevent the absorption

of moisture. Before drying, the mold in bread is light green, but upon drying it darkens. It will keep for several months in a dark, dry place.

METHODS OF PACKING:

Roquefort cheese is marketed in wooden boxes (pine, white-fir, or spruce), holding 3, 6 or 12 cheeses each. The 12-cheese boxes are 8 in. by 8 in. by 3 feet 9 in., inside dimensions. They are divided into 3 or 4 compartments to hold three or four cheeses each. The sides, top, and bottom, are $\frac{3}{8}$ in. thick, and the ends and compartment pieces $\frac{11}{16}$ in. thick. The 6 and 3-cheese boxes are made, proportionately smaller, from similar material.

The cheese is wrapped neatly and securely with foil. The dimensions of the foil are 22 in. by 13 in., and there are from 18 to 25 sheets to a pound. The foil is separated from the cheese by a layer of thin paper to which it is attached. Ordinarily, the trade name and design are printed in black upon the foil. When the cheeses are ready for shipment, they are wrapped in strong paper and tied with a cord. This holds them in shape and gives protection in transit. The net weight of cheese is marked on the paper.

The wrapped cheese is then packed in sawdust, pine shavings, or excelsior, to absorb any leakage brought about by a change from low to high temperatures. No difficulty has been encountered from the cheese absorbing odors from the box or packing materials.

IOWA BLUE CHEESE (ROQUEFORT TYPE CHEESE MADE FROM COW'S MILK)

Iowa Blue cheese is a Roquefort type cheese made from cow's milk. Roquefort type cheese possesses a distinct peppery flavor due to the growth and activity of certain molds. Many types of cheese are known in which one of the major ripening agents is a mold, the growth of such a mold throughout the cheese producing a distinctive and characteristic marbled blue color. This class of cheeses is referred to as "blue vein," because of its appearance. In addition, the enzymes elaborated during the growth of the mold produce a typical, pleasing, peppery flavor, largely responsible for the high esteem in which Roquefort type cheese is held.

The present efforts of the Iowa State College of Agriculture to develop this type of cheese under the supervision of Goss, Neilsen, and Mortensen, were directed particularly towards producing a type of blue cheese which could be made by a simple, inexpensive and easily controlled process. The process described below is similar, in some respects, to the conventional French process.

METHOD OF MANUFACTURE:

The procedure followed in the manufacture of Iowa Blue cheese is given in some detail below. The directions are as precise as it is possible to give at this time. The cheese maker must acquire some experience, in order to afford a basis for the successful control of certain physical properties of the curd which, in turn, determine the quality of the final product.

The milk used in the experiments averaged 3.34% fat. To it was added cream to raise the average fat content to 3.79%. A normal milk with 3.8 to 4.2% fat has also been used with success. Pasteurization of the milk for Iowa Blue cheese has not proved advantageous. Cheese made from pasteurized milk does not develop as much surface growth of bacteria and molds; a lesser degree of flavor is present, and the cheese does not become as sweet during curing, as the raw milk product. The pasteurized milk cheese carried 49.0% moisture in the 23 hour drained curd as compared with 47.4% moisture in the raw milk product. The poorer drainage properties of the pasteurized milk curd make it more difficult to obtain the right sort of body and texture. Losses of fat in the whey were 0.04% lower for pasteurized milk (which is so slight that it is not significant). More experience with this sort of cheese will be required before the modifications necessary to avoid certain ill effects of pasteurization can be specified. It seems at present that Iowa Blue cheese made from raw milk cures in a more nearly normal and satisfactory manner than that from pasteurized milk.

RIPENING THE MILK:

After the milk has been placed in the usual American cheese vat, 1.5 to 2% of ordinary lactic cheese starter for ripening the milk is added. The acidity is permitted to increase until 0.19 to 0.20% has been reached, which usually requires from 1 to 1½ hours. At the end of the ripening period, the Marshall rennet test will show 1¼ to 1½ spaces. It is essential that an active and rapid lactic acid-producing starter be used. An inactive or slow culture will not facilitate satisfactory drainage, and the composition of the cheese cannot be controlled.

When cream is added to raise the fat content of the milk by approximately 0.4%, the increase in the ratio of fat to casein does not appear to cause any special difficulty in obtaining a sufficiently open cheese or satisfactory drainage. The setting temperature of 84° F. is lower than that commonly used for most varieties of cured cheese, but this lower temperature seems to aid in the production of the desired body and texture.

SETTING THE MILK:

When the acidity test shows 0.19 to 0.20% present, the rennet extract is added at the rate of 3 fluid ounces or 90 cubic centimeters per thousand pounds of milk. (The rennet is first diluted with 20 times its volume of cold water.) Just before the rennet extract is added, the milk is set in motion. Thorough mixing should continue for 1 or 2 minutes to insure uniform distribution of the rennet extract. It will be noted that no color is added since it is desired to have the finished cheese as white as possible. The veining with the blue mold then shows up in sharp contrast against the uncolored cheese.

CURDLING PERIOD:

A relatively long curdling period is used, usually 1¾ to 2 hours. During this time the milk thickens, then curdles completely and becomes progressively firmer, more brittle and inelastic. Beads of whey will stand out on the surface of the curd, gradually becoming larger areas until the entire surface is covered with a thin film of clear whey. The curd is now ready to cut. Sometimes in the case of milk, slightly riper than usual, the curd will shrink away from the lining of the vat before it is ready to cut.

CUTTING THE CURD:

With ½ inch wire curd knives the curd is cut into cubes by means of a horizontal cut lengthwise, followed by a vertical cut across the vat, and finishing with a longitudinal cut with the same knife. Following this, the whey will separate rapidly and the curd begin to settle out. An acidity test of the whey taken immediately after the cutting is completed will commonly show 0.14 to 0.15% of acid. Lower acidities have frequently been followed by difficulty in drainage.

FIRMING THE CURD:

Following the completion of the cutting operation, the curd is left undisturbed for about 15 minutes. At the end of this period it is stirred gently to prevent matting and the operation repeated at intervals of a few minutes for the next half hour. Fifty minutes after cutting, the temperature of the curd is raised 2 or 3° F., by dipping out a pail of whey and heating it to a temperature of 170 to 180° F., by injecting steam directly into it. Enough whey can easily be heated in this manner to raise the curd temperature sufficiently without danger of the curd matting in the bottom of the vat. It also avoids too much heat being applied, which might occur if steam were admitted into the jacket to

heat the curd. The hot whey should be added carefully to the vat and then be thoroughly distributed with the wooden curd fork.

DIPPING THE CURD:

The firming temperature of 86 to 87% F. will slightly toughen the curd in a few minutes, and the acidity by this time will have reached 0.18 to 0.19%. This slight toughness prevents too much breaking up of the curd on the cloth, to which it is now to be transferred. When the toughening process has proceeded for about 15 minutes, some of the whey is drawn off through the vat gate, and one-half of the curd is transferred by means of curd scoops or flat sided curd pails to a nearby drain vat. At the bottom of this vat is a rack over which two of the Swiss cheese cloths are spread. Drainage of the curd is assisted by raising and lowering the corners of the cloths occasionally, but too much manipulation will cause unncessary breaking of the curd and loss of cheese solids. After 15 to 20 minutes the curd becomes a slightly tough, lumpy, porous mass. There will be very little free whey passing from it.

HOOPING THE CURD:

The hoops used in this work are the so-called "Meunster style" mold, made of heavy tinned-steel, round, 7½ inches in diameter, open at both ends, with 6 rows of twenty ⅛ inch holes drilled in the side for drainage. If the room is not sufficiently warm, it is well to dip the hoops in hot water just before using them. The curd may have cooled a degree or two during drainage before being placed in the hoops. The hoops may be placed on boards or directly upon a draining table, and each hoop filled one-fourth full with the pulpy, irregular curd.

Upon this first layer of curd is dusted a light layer of the prepared mold powder, using a pepper box. Following this, a second and third portion of curd is added, and upon each layer, mold powder is sprinkled lightly. The last fourth of the curd needed to fill the hoop is placed over the third layer of mold so that the hoop is filled with alternate layers of curd and mold powder. In the cheese made in this laboratory 0.06 to 0.07% of mold powder gave excellent results. Unless suitable laboratory facilities are available it will probably be more satisfactory to obtain the mold powder from a reliable laboratory than to attempt to prepare it in the dairy plant.

The curd is not packed in the hoop, nor is any follower or weight used. If the correct physical condition of the curd is obtained and the temperature is favorable, the surface of the cheese will close up reasonably well, but the cheese will remain rather open through the interior. The closing of the surface is desirable as it gives a smoother, cleaner appearance to

the finished cheese and reduces losses during curing, but the open interior is necessary for proper mold growth. If difficulty is experienced in obtaining a smooth, well closed surface, after draining for 20 minutes the cheese may be surrounded with a small square of cheesecloth dipped in warm water. This procedure will insure a well closed surface, but this precaution has not generally been necessary in the college laboratory. Curd remaining in the whey still in the vat is now transferred to the cloths. This curd will have firmed somewhat during the draining and filling of the first lot of curd, so that drainage of the remainder will require less time. Fat losses in the whey average 0.25%.

DRAINING THE CHEESES:

After 20 or 30 minutes in the hoops, the cheeses are turned to smooth the upper surfaces and to facilitate drainage. A special draining room is not used in this work; the cheeses are placed on cloths in the drain vat in the mixing room and their temperature held between 75 and 80° F. Usually there are five turnings of the cheeses at increasing intervals of time during the afternoon. It is important that the temperature be held sufficiently high to facilitate drainage, but not so high that the open texture is lost. The high drainage temperature permits the curd to drain sufficiently so that it may be salted within 24 hours after it is made. During the drainage period the weight of curd decreases to 3.02 pounds of cheese per pound of fat, based on the records of approximately 8,000 pounds of cheese. The cheese will show 45 to 46 % of moisture when it is ready to salt.

SALTING:

The salting of this type of cheese presents one of the major problems from the standpoint of producing uniform quality. A combination of brine and dry salting has been used to obtain the 4% (or more) of salt desired in the final product. Following drainage, the cheeses are held at a temperature of 75 to 80° F. over night, and are then placed in a wooden salting tank containing a saturated solution of butter salt. The temperature is kept near 55° F. The cheeses are sprinkled lightly with dry salt on the exposed surface and the next day are turned over in the brine and the upper surface again lightly salted. At the end of the second day in the brine the cheeses are removed and dry salted rather liberally on all surfaces. This dry salting is repeated in 48 hours. At the end of another 48 hours the cheeses are rinsed off with clear water. The entire salting operation covers a period of 6 days; during the first two days the cheeses are kept in brine and during the last four they are dry salted. During the salting period the surface of the cheeses becomes very firm but shows

little evidence of surface growth. The hardness of the surface is not due to air drying but to the effect of the salt. Samples of good quality imported blue cheese have been analyzed which showed as high as 5.7 salt. It is important that a carefully prepared sample show a salt content somewhat above 4.0%, upon completion of the salting process. During the salting period the cheese continues to lose weight, producing 2.89 pounds of salted cheese per pound of fat, as compared with 3.02 pounds of cheese per pound of fat at the beginning of the salting process. The acidity of the brine increases with use, and should be kept below 0.3% by the addition of proper amounts of milk of lime made from clean, unslacked, lump lime.

PUNCHING THE CHEESE:

At the end of the salting period excess salt is rinsed from the cheese surfaces and (when the surplus moisture has disappeared) the cheeses are skewered.

The proper growth of the flavor-producing mold culture requires that a certain amount of air, in addition to that present when the curd is placed in the hoops, be admitted during the curing process. This additional air is provided by skewering or pricking the cheese in about 50 places with a ⅛-inch diameter needle. These openings are evenly distributed over the flat sides of the cheese, permitting better growth of the mold in the many natural openings of the cheese, especially along the line of puncture. If large quantities of cheese are to be made, a special machine should be used for punching in order to economize on labor and produce more uniform results.

CURING:

The cheeses are placed on edge on special racks for the curing period, which takes approximately 2 months. During this period the temperature of the curing room in which the cheeses are placed is held at 45 to 48° F. and the humidity above 90 per cent of saturation with slight or moderate air circulation.

The rooms used can be insulated with 4 inches of cork and provided with a floor drain and cold water connections; the cooling is effected by means of wall brine coils on one side of the room. High humidity and a slight air movement are produced by a fine water spray located at the top and discharging into a galvanized iron cylinder 6′ × 1′6″, open at both top and bottom, extending within a foot of the 8-foot ceiling and ending 1 foot above the floor not far from the drain. A fine spray of water passing downward through the cylinder humidifies and circulates the air, the excess water passing onto the floor and down the drain. Manual

adjustment of a valve on the water line regulates the humidity and, to some extent, the air circulation. A difference of about 1° F. between the wet and dry bulb thermometer readings should be maintained. The effectiveness of the curing conditions is also determined by the sequence of fermentations on the cheese surfaces, the appearance and stickiness being used as evidences of the desired curing room conditions.

During the first 3 or 4 weeks following the pricking of the cheese a blue-gray mold developes in patches over the surface, sometimes almost covering the cheese. Some sticky surface growth is mingled with the mold, but the mold should predominate. At this stage the surface mold and bacterial growth is removed by immersion in cold water in a vat for ½ to 1 hour, which will soften the surface sufficiently so that a stiff brush may be used to render the cheese white, before replacing it in the curing room. During the second period of 3 or 4 weeks under curing room conditions, the reddish-brown sticky surface growth will almost entirely displace the mold (which predominated during the first month). This reddish-brown layer will probably need to be removed twice during the curing process. Its development is an evidence of a normal cheese and, to some extent, of suitable curing conditions. If, however, it becomes too vigorous the surface of the cheese softens too deeply, and large losses result. High temperatures and infrequent removal favor too luxuriant growth. The removal of the surface growth with the brush is responsible for some loss of weight during curing. The high humidity of the curing room largely prevents evaporation of moisture from the cheese so that little loss of weight occurs on this account. The total loss of weight from the time the cheese is placed in brine until it is enclosed in foil amounts to 9.67%.

PLACING IN FOIL:

After 8 or 10 weeks in the curing room, the last removal of surface growth takes place and the white cheeses are enclosed in pure block tin foil (as soon as surface moisture has largely disappeared). The foil should be pressed upon the surface of the cheese with the hands so that there will be close contact between the foil and cheese. The foil should bear the brand and other information, in which case the sheets of foil will be hand-leaved with tissue paper. The cheeses can be handled with this tissue paper to keep the outside surface of the foil entirely clean. A yield of 2.72 pounds of cured cheese per pound of fat at the time the cheese was inclosed in foil can be obtained.

The cheese should be held for at least 1 month in foil at a temperature below 45° F., or at 32° F. for a storage period of some months. During this ripening period in foil more of the characteristic, peppery flavor

develops and the cheese becomes sweeter, losing certain raw curd characteristics which have not entirely disappeared at the time the cheese is inclosed in foil. The total time from making to selling for a milk-cured cheese will be 3 to 4 months.

PACKING FOR SHIPMENT:

Absence of a definite rind and the friable characteristics of the cheese require precautions in handling and shipping to prevent injury. Just before shipment, each cheese is wrapped with white parchment paper and tied with a heavy cord around its circumference. Cheeses for express or freight shipment should be packed in ½ dozen lots, surrounded with clean excelsior in a special wooden box 7¼ inches wide, 10 inches deep and 22½ inches long (inside dimensions). The tops and sides are ⅜ inch, and the ends ¾ inch in thickness. For a single cheese a strong corrugated fiber box just large enough for the cheese can be used for express and parcel post shipments.

YIELD:

A yield of 2.72 pounds of Iowa Blue cheese per pound of fat can be obtained. (This yield is at the time the cheese is inclosed in foil.) After the cheese is in foil the loss in weight will be relatively small, especally if it is stored for no longer than 1 or 2 months. The above yield would be at the rate of 10.88 pounds of cured cheese per 100 pounds of 4% milk.

The average composition of 9 cheeses from representative lots made by the method outlined contained 34.5 percent fat, 36.66 percent moisture and 4.79 percent salt. There was 54.5 percent fat in the dry matter.

PROCESSED CHEESES:

Processed cheeses offers to the manufacturer a new field for the sale of their milk products. While the manufacture of cheeses has always been an accepted commodity, processed cheese offers a new way to make a variety of flavor and taste blends, which are meeting with consumer acceptance and increased business.

AMERICAN PROCESSED CHEESES:

For a white product a white cheese should be used throughout; in making a yellow or orange product, the proper amount of annatto color is added. The name "cheese" in the following formulas means Cheddar cheese (American cheese, American Cheddar cheese).

Formula No. 1

Young (green) American Cheddars	6 cheddars
Sharp American Cheddar	1 cheese
Salt	3 pounds
Sugar	2 pounds
Di-sodium phosphate	13 pounds
Water	4 gallons

1. The total weight of cheese equivalent to seven cheddars should be kept constant.

2. The ratio of sharp to young cheese may be varied to meet flavor requirements.

3. The water content should be adjusted so that the final product does not contain more than 40% moisture; 50% of the total solids should be butterfat.

4. It is suggested that half a cheddar of young cheese be left out in the above formula and replaced with any or all of the following:

a. Previously prepared process cheese
b. Swiss cheese
c. Part skimmed cheese. The use of strong cheeses should be avoided as much as possible and the moisture limits and legal fat content should be watched closely. Stainless steel, or a similar unreactive metal, is to be used for the stirrers, which are constructed for efficient scraping down of the sides of the kettle. The blades should be constructed to permit agitation on all levels (half of the blades should turn clockwise and the other half counterclockwise). The lid should be constructed of two tight-fitting halves with a draw-off at the lowest point in the kettle. In manufacturing processed cheese, about ¾–1 cheddar of ground cheese should first be added to the kettle and melted down; water, sugar, salt, phosphate and finally the rest of the ground cheddars are then added. The contents are heated to 170° F. and held there for 10 to 15 minutes. The processed cheese is now drawn off into filling machines.

MODIFICATION OF ABOVE FORMULA:

1. Brick blended with one young American cheddar and an equivalent amount of limburger added.

2. Three or four cheddars and an equivalent amount of Swiss added. The rest of the ingredients are added in the same proportions as in the above formula.

Italian Type Process Cheese:

Formula No. 1

	I	II	III
Green (young) American cheddar	1½ lb.	—	—
Sharp (Aged) American cheese	2 lb.	1 lb.	1 lb.
Sbrinza (Argentina)	2 lb.	4 oz.	6 oz.
Monterey (Argentina)	½ lb.	—	—
Sodium chloride	1 oz.	½ oz.	½ oz.
Di-sodium phosphate (anhydrous)	2 oz.	—	—
Water	1¼ pt.	½ pt.	⅝ pt.
American processed cheese	—	2 lb.	2½ lb.
Romano	—	⅜ lb.	½ lb.
Di-sodium phosphate (USP)	—	1½ oz.	—
Sodium citrate	—	—	2 oz.

Italian Type Pimento (Very Sharp) with Red Pepper:

Formula No. 2

Sharp American cheddar	3 lb.	1 lb.
American processed cheese	2 lb.	3½ lb.
Water	¾ pt.	2 oz.
Monterey cheese	2 oz.	—
Romano cheese	4 oz.	—
Red peppers	¾ oz.	¾ oz.
Pimento meat	4 oz.	4 oz.
Salt	½ oz.	½ oz.
Di-sodium phosphate (USP)	2 oz.	2 oz.
Pimento juice	—	½ pt.

Formula No. 3

	I	II	III	IV	V
Munster cheese	7 lb.	7 lb.	7 lb.	8 lb.	7 lb.
Swiss cheese (American)	12 oz.	12 oz.	12 oz.	—	—
American cheddar	1 lb.	1 lb.	1 lb.	3 lb.	3 lb.
Sodium citrate	3 oz.	—	4 oz.	2½ oz.	3 oz.
Di-sodium phosphate (anhydrous)	1 oz.	4 oz.	—	1 oz.	1 oz.
Sugar	4 oz.	4 oz.	8 oz.	1 oz.	1 oz.
Whey powder	2 oz.	2 oz.	2 oz.	2 oz.	2 oz.
Water	⅝ pt.	¾ pt.	¾ pt.	½ pt.	½ pt.

LACTIC ACID PREPARED FROM MILK:

There are three grades of lactic acid, made from calcium lactate of different degrees of refinement. (1) The commercial acid is made from concentrated crude calcium lactate liquor from the vacuum pan after the first evaporation, (2) the edible grade from the centrifuge after the first crystallization and (3) the water white U.S.P. grade from the purest grade of calcium lactate.

Concentrated, crude calcium lactate as it comes from the vacuum pan is decolorized in a wooden mixing tank, treated with sulphuric acid and separated from the calcium sulphate and other precipitates by filtration. The concentration of the lactic acid coming out of the filter-press is about 22%; (this product is suitable for sale as commercial acid). In manufacturing an edible grade of lactic acid, the process of refinement is repeated from the standpoint of using decolorizing carbon, etc. The liquor coming out of the filter press is subsequently concentrated in stainless steel evaporating pans. The acid sold to the trade known as "edible lactic acid" averages about 50% by weight. This acid is almost as clear as water, free from high ash and unpleasant odor. One pound of lactose theoretically produces 1.17 pounds of 50% lactic acid.

Lactic acid is finding increasing favor in the manufacture of ice-cream, sherberts, soft drinks, and fruit syrups. It is extensively used in the salt brine used in olive processing, to adjust the acidity and to retard the growth of bacteria, which may occur when grinds are too low in acidity.

BUTTER MANUFACTURE:

Butter can be made from the milk of sheep, goats, buffalo and other animals, but the product that we know and consume is usually made from cow's milk. The old-fashioned method was to allow the milk to stand for about a day and then place the cream (which had risen to the top) in earthern crocks, to be held there until sufficiently ripened or soured by the action of the lactic acid bacteria. There are many pitfalls in this process of manufacture, especially if the atmosphere surrounding the cream is infected with the wrong kind of bacteria during the ripening process.

When the creamery method is used, the cream is generally separated from the whole milk (while it is still sweet), by running it through centrifugal separators. It is pasteurized, then treated by the addition of a lactic acid starter, which consists of pasteurized skimmed milk previously curdled by the addition of pure cultures of lactic acid bacteria. Butter made from sweet cream, without the aid of a starter, is flat in flavor and lacking in aroma. Proper use of a good starter results in the butter (made from sweet cream or neutralized sour cream) having a distinct character, good flavor and pleasant aroma.

The next step in the process is churning, which brings the fat globules into contact with each other, to unite into granules of butter. The granules are drained of the remaining liquid (which is the butter milk), then washed and salted, and finally worked into the finished homogenous product.

Butter should not have a lardy, oily or greasy flavor. It should be

neither oily nor dry in appearance, nor cloudy or streaked. It should be free from holes or crevices, as these enclose moist air and favor fermentation. Renovated, or processed butter is produced by reworking low grade or slightly deteriorated lots; the butter is melted and allowed to settle; then the froth and curd are skimmed off and the mixure freshened by strong currents of air. Fresh inoculated bacteria milk cultures are added. The butter is then churned rapidly, cooled and worked to remove any excess of milk. However, there are differences between fresh and renovated butter and it should not be sold as fresh butter.

FRUIT FLAVORED MILK BEVERAGES:

The production of this type of beverage is possible only when certain considerations and regulations are complied with. The chief considerations in the production of fruit flavored milk beverages are the prevention of curdling, control of acidity, sweetness and production of a true fruit flavor. The curdling of milk refers to the coagulation of casein; this coagulation starts at a pH of 5.5 and ceases at a pH of 4.7. (The acidity of the milk increases as the pH decreases.) From this it becomes evident that the progressive addition of an acid syrup at first causes a slight precipitation of casein and, when the acid is sufficiently concentrated, the curd is formed, with whey as the by-product.

Acidity, therefore, is an important consideration and must be very carefully controlled to regulate, or completely to prevent, even a trace of curd. The amount of sugar added for sweetening purposes is important because addition in too large quantities offsets the fruit flavor. The addition of a large quantity of fruit flavor often causes the milk to curdle. Unless there is a sufficiently strong fruit aroma, the milk beverage may be very unsatisfactory, since milk requires a powerful flavor to mask its own aroma and taste.

The suggested fruit flavors for making milk beverages are:

Strawberry	Black currant
Raspberry	Loganberry

The most satisfactory proportion of milk to syrup is one hundred parts of milk to twenty parts of fruit syrup. The syrups listed below when added to milk introduce a characteristic flavor without curdling.

Flavor	*Sugar %*	*pH of Syrup*	*Acid %*
Strawberry	66%	5.85%	.4 %
Raspberry	64%	4.09%	.62%
Loganberry	65%	4.32%	.92%
Black currant	65%	4.70%	1.5 %

The addition of these fruit flavored syrups in the proportion of twenty parts to 100 parts of milk will regulate the finished milk beverage so that the pH will average about 5.5 and the acidity will be regulated so that a curd will barely form or not at all.

CHAPTER IV

CONFECTIONERY, CHOCOLATE PRODUCTS, COFFEE, TEA

CANDY PRODUCTS

CHOCOLATE PEANUT BARS

Sugar	3 lb.
Corn Syrup	3 lb.
Water	1 pt.

Cook to 240° F., then add 8 lbs. of washed peanuts and cook for 10 minutes. Remove from fire, and roll out on a slab. Cut into small pieces and dip in chocolate.

COFFEE CARAMELS

Sugar	4 lb.
Corn Syrup	3 lb.
Cream	½ gal.
Good Java Coffee	½ gal.

Cook the above to 238° F. Then add 1 quart sweet cream and cook to about 242° F. Remove from fire, pour on greased slab.

BUTTERSCOTCH SQUARES

Sugar	10 lb.
Corn Syrup	4 lb.
Water	3 pt.

Cook to 285° F.; add 4 ounces of butter, ½ teaspoonful of salt. Stir and cook to 295° F. When cooled down flavor with oil of lemon. Pour on greased slabs.

EVERTON TOFFEE

Sugar	4 lb.
Water	3 cupfuls
Cream of Tartar	½ teaspoonful
Butter	2 oz.

Put the water, sugar, and cream of tartar into a pan and stir until they boil, but no longer. Add the butter after the other comes off the fire, but do not stir it in.

LICORICE DROPS

Sugar	12.5	lb.
Water	3	pt.
Cream of Tartar	1	dr.
Powdered Extract of Licorice	1	oz.
Oil of Wintergreen	30	min.
Oil of Anise	20	min.
Powdered Charcoal	1	dr.

Cook the sugar, water, and cream of tartar to 340° F.; pour out on an oiled slab; add the other ingredients, and fold and knead until well mixed; then stamp into drops.

FRUIT JELLY CANDIES

Fruit Juice	2	qt.
Sugar	3	lb.
Corn Syrup or Invert Syrup	3	lb.
Commercial Pectin Syrup	1	qt.

Mix fruit juice and pectin syrup. Add the sugar and corn or invert syrup. Boil to 222–223° F. Remove from fire. Pour into starch molds or oiled pans, about ½ inch deep. Allow to harden 24 hours. Remove from molds and dust with powdered sugar or dip in chocolate.

FRUIT CARAMELS

Sugar	2	lb.
Chopped Walnuts	½	pt.
Corn Syrup	1¼	lb.
Ground Dried Fruit	1	lb.
Butter	2	oz.
Cream (Whipping)	2	qt.

Cook sugar, corn syrup, and ½ of cream to 238° F., then add ½ of remaining cream and cook to 242° F., add remaining cream, dried fruit, butter, and chopped nuts and cook to 248° F. Pour into an oiled pan or onto a slab to cool and harden.

FRUIT MARSHMALLOWS

Powdered Edible Gelatine	4	oz.
Hot Water	1	pt.
Corn Syrup	2½	lb.
Powdered Sugar	2½	lb.
Dried Apricots, Figs, Prunes, Pears, Chopped or Whole Raisins	3	lb.

Dissolve the gelatin in hot water. Cook corn syrup to 250° F. Beat into it the dissolved gelatin and powdered sugar until the mixture is light. Flavor with vanilla. Then add the dried fruit. Beat a short time and

pour on oiled paper or a slab to harden. Fruit syrup may be used instead of dried fruit—¾ pint.

MOLASSES WAFERS

Sugar	5 lb.
Corn Syrup	1 lb.
Water	1½ pt.
New Orleans Molasses	1 pt.
Butter	¼ lb.

Stir and cook to 290° F. Roll out on a greased slab.

MARASCHINO CHERRIES

Place in a paraffin-lined barrel, or a crock, or a bottle, all depending upon amount, firm ripe Royal Ann Cherries. Do not remove the stems. Cover the cherries with the solution made as follows:

Water	1 gal.
Bisulphite of Soda	1 gal.
Citric Acid	½ oz.
Salt	6 oz.

Dissolve the above ingredients. Let stand until cherries are bleached, which may take 2 weeks or longer. Then discard the solution. Stem and pit the fruit. Boil the fruit in 5 or 6 changes of water until free from sulphur taste and until tender. Prepare a 40% sugar solution, and for each 10 gallons of cherries dissolve ⅙ ounce of certified red color, Ponceaux 3R. Also add ½ teaspoonful citric acid. Now cover cherries with this sugar colored solution, and cook for 10 minutes. After 24 hours, cook cherries and syrup again, after adding 10 pounds of sugar. Repeat this again on third day. Then allow to remain in crock for 2 weeks. Now add ¼ ounce of bitter almond oil dissolved in a little alcohol, for flavor. Instead of the red, a green food color may be used, and instead of wild cherry, mint flavor may be added.

WILD CHERRY DROPS

Sugar (Crystal A)	4 lb.
Water	1 pt.
Cream of Tartar	24 gr.
Extract of Bitter Almonds	3 dr.
Powdered Orris	3 dr.
Red Color	Sufficient

Cook the sugar, water, and cream of tartar to 335° F. Pour out on an oiled slab; let it cool a little; add the extract, the orris, and the color. When cool enough, work thoroughly and stamp into drops.

ANISEED DROPS

Sugar (Crystal A)	5 lb.
Water	22 oz.
Cream of Tartar	40 gr.
Oil of Anise	40 min.
Red Color	Sufficient

Put the sugar in a suitable container; add the water and the cream of tartar. Cook to 335° F.; pour out on an oiled slab; as it cools add the oil of anise and the color; fold over until cool enough to handle, then work thoroughly and stamp into drops.

NUT GLACES

Sugar	10 lb.
Corn Syrup	2½ lb.
Water	3 pt.

Cook sugar and water to 290° F. Shut off heat and drop in nuts to be sugar coated or glaced. Remove with fork.

REVIVIFYING DRY POPCORN

Popcorn which pops poorly because of having become too dry may be restored to good popping condition by the following method:

Put 40 pounds of corn into a 10-gallon can.

Add 1 to 3 pounds of water, according to the dryness of the corn, as indicated by the way it pops. If its popping yield is less than one-third the normal yield of the variety, add 3 pounds of water; if it is two-thirds normal, add only 1 pound. For intermediate degrees of popping add intermediate quantities of water. For different varieties of popcorn the normal popping yield varies from 15 to about 30 volumes.

Put on the cover, using a rubber, and clamp it down tightly.

Shake thoroughly.

Leave stand two days or longer before popping.

The poor popping quality of some lots of corn is due to other causes than lack of moisture. In such cases the popping cannot be improved by adding water.

The above method of restoring poppability is applicable only to small quantities of corn. When it becomes necessary to increase the moisture content of a large quantity of popcorn, it should be done by storing the corn in a cool, damp place, as, for example, in a shed outside during winter, or in a basement room during summer.

POPCORN FRUIT CRISP

Sugar	3 lb.
Corn Syrup	1½ lb.
Water	1 pt.
Popcorn (popped)	4½ qt.
Butter	3 tbsp.
Dried Fruit Chopped	¾ lb.
Salt	Suffcient to flavor

Cook sugar, corn syrup, and water to 285° F. Add the butter, salt, and fruit and stir. Now stir in the popcorn. More or less popcorn can be added to suit.

SALTED PEANUTS

In a kettle on a gas flame, add coconut oil and heat to about 300° F. In a basket add shelled Spanish peanuts. Immerse this basket in the hot oil, and roast until brown. Now pour peanuts over a fine sieve, and when the oil has drained off add the salt.

UNWRAPPED LICORICE CARAMELS

Cane Sugar	60 lb.
Corn Syrup (43°)	50 lb.
Cream (40%)	4 gal.
Fresh Unsweetened Whole Condensed Milk (10%)	5 gal.
Sweetened Whole Condensed Milk (8%)	3 gal.
Table Salt	6 oz.
Fat (140 m.p.) (Hydrogenated Peanut—or Cottonseed Stearine)	2 lb.
Licorice Syrup	8 lb.

Put all ingredients except color and licorice in kettle. Cook to a soft ball. Add licorice syrup and black color. Cook batch to hard ball in cold water. Pour on slab and let stand overnight. Cut to size desired. No wrapper is required for this excellent "stand-up" caramel. Put in waxed paper cups.

LICORICE TAFFY

Cane Sugar	15 lb.
Licorice Syrup	8 lb.
Cocoa Butter	1 lb.
Corn Syrup (43°)	13 lb.

Place in kettle; cook to soft ball in cold water and add licorice syrup; cook to hard ball, add black color, and spread out on marble to desired thickness. Let cool and cut to suit. Wrapper should be about 20-pound white waxed.

This is a splendid number for wax-wrapped five- and ten-cent bars. May also be used to increase variety and give novelty to chocolate and bonbon centers. Makes an excellent center for pan goods.

LICORICE JELLY GUM DROPS

Gum Arabic	50 lb.
Cane Sugar	80 lb.
Licorice Syrup	12 lb.
Corn Syrup (43°)	5 lb.
Water	4 gal.

Soak gum in hot water, using 1 pound of gum to 1 quart of water. Let stand in hot room overnight. Skim off and strain through very fine sieve.

Cook sugar, corn syrup, and water to 250° F. Add licorice syrup and black color and continue to cook to 255°. Add gum and cast in starch. Put in hot room for 48 hours. Take out and let stand until cool. When cool, remove from starch and place in crystal pans. Use crystal cold cook to 232°. Leave in crystal overnight.

The smaller sizes of licorice jelly gum drops make excellent centers for pan work. For this work they are, of course, not crystalized. Put them in the pan after removing them from starch and handle them the same as you would jelly beans or cordial drops. Do not color the syrup but finish white.

Chocolate or bonbon-coated, this luscious jelly gum drop makes an excellent addition to the conventional cordial box or summer package.

HARD LICORICE DROPS (PASTILLES)

Gum Arabic	60 lb.
Cane Sugar	36 lb.
Glycerin	3 oz.
Licorice Syrup	12 lb.
Corn Syrup	6 lb.

Melt gum in the proportion of 1 pound to 1 quart of hot water, and let set overnight in hot room. Bring to a boil next day and strain through a very fine sieve.

Cook sugar and corn syrup to 280° F., add gum, licorice syrup, and black color, and put in hot room overnight. Next morning, skim off and cast in starch.

Place in hot room again and allow to set for three days (temperature of hot room to be maintained between 130° and 140° F.). After removing goods from the hot room, let stand for about 24 hours to cool. Clean off starch and return to hot room until goods are hot, rub in refined petrolatum (white vaseline) until the desired shine is obtained.

WRAPPED LICORICE CARAMELS

Corn Syrup (43°)	10 lb.
Cane Sugar	30 lb.
Cocoa Butter	3 lb.
Cream (40%)	4 gal.
Licorice Syrup	6 lb.

Put all ingredients except black color and licorice syrup in kettle. Cook to a soft ball. Add licorice syrup and black color. Cook to a hard ball in cold water. Pour on slab and allow to stand overnight. Cut and wrap.

LICORICE MARSHMALLOW CARAMELS

Cane Sugar	60 lb.
Corn Syrup (43°)	50 lb.
Cream (40%)	4 gal.
Fresh Unsweetened Whole Condensed Milk (10%)	5 gal.
Sweetened Whole Condensed Milk (8%)	3 gal.
Table Salt	6 oz.
Licorice Syrup	8 lb.

Put all ingredients except color and licorice in kettle. Cook to a soft ball. Add licorice syrup and black color. Cook batch to a hard ball in cold water.

Turn out ⅛ inch thick. On this lay a sheet of sheet marshmallow. Put top piece of licorice caramel on when batch is cool enough to handle.

Cut and pack in waxed paper cups, straight-packed or in assortments, alternating rows with plain licorice caramels.

LICORICE CARAMEL-NOUGAT CENTER FOR CHOCOLATES OR BONBONS

Corn Syrup (43°)	10 lb.
Cane Sugar	30 lb.
Cocoa Butter	3 lb.
Cream (40%)	4 gal.
Licorice Syrup	4 lb.

Mix half licorice caramel and half vanilla nougat. Do not add any additional color. The resulting batch will be lighter than licorice caramel but of good color.

The licorice-caramel-nougat mixture makes a particularly fine eating piece of candy and is confidently recommended to those who seek something distinctive in the way of chocolate or bonbon centers.

LICORICE TURKISH PASTE

Cane Sugar	75 lb.
Corn Syrup (43°)	15 lb.
Cooking Starch	9 lb.
Cream of Tartar	6 oz.
Licorice Syrup	20 lb.
Water	4 gal.

Put sugar, corn syrup, and water in kettle and bring to boil. Add cooking starch which has previously been soaked in 1 gallon of cold water.

After batch has boiled 10 minutes, add cream of tartar (previously

melted in 6 ounces of water). Next add licorice syrup and continue boiling until batch is finished (cook until it drops easily from a knife).

Two Oriental delicacies in one. A licorice confection of mild character and velvety texture.

LICORICE STRINGS, OPERA DROPS OR A. B. GUM-WORK

Cane Sugar	50 lb.
Corn Syrup (43° Bé.)	135 lb.
Cream of Tartar	2½ oz.
Tartaric Acid	1½ oz.
Special Thick-Boiling Starch	20 lb.
Licorice Syrup	12 lb.
Water	8 gal.

Put sugar and corn syrup in kettle with water. Bring to a boil. Add starch, which has been previously melted in 3 gallons of cold water, and cream of tartar. Cook 1 hour. Add licorice syrup; cook for another half hour, making a total cooking time of 1½ hours. Turn off steam, add vegetable black color, and finally add acid which has been melted in a little hot water.

Cast in blood-warm starch (98°–100° F.); leave in hot room (at 140° F.) for three days; take out of hot room and let stand until cold.

When cold, sugar up and let stand in hot room or a good dry room for 24 hours.

Cook crystal to 233° F., apply on goods hot; leave goods in crystal for 10 hours; drain off crystal and empty crystal pans into boards. Be sure goods are thoroughly dry before packing.

This formula makes a tender and delicious-eating string or drop. It can also be used for A.B. gums, if desired.

LICORICE PASTE FOR BAG WORK

Powdered XXXX Sugar	10 lb.
Licorice Syrup	1 lb.
Whites of eggs, well beaten	8 oz.

Beat egg whites to a stiff fluff. Add sugar and licorice syrup, and sufficient black vegetable color to get the desired shade.

Keep this paste in a covered container and use as needed.

Sets up brittle and "crunchy" like a biscuit. A deliciously flavored paste for making "dominoes," "clubs and spades," Hallowe'en witches and black cats, and all sorts of holiday bag work and bag work novelties.

LICORICE BONBON FONDANT (NATURAL COLOR)

Cane Sugar	80 lb.
Egg Whites	1 pint
Water	2½ gal.
Licorice Syrup	8 lb.

Cook sugar and water to 242° F., pour on ball beater and let cool. Beat egg whites to a stiff fluff, add to batch, and start beater. When thoroughly mixed, add licorice syrup. Use no color. When fondant is finished, put it in a cream tank. Do not use a wet cloth to cover fondant; use a metal or wood cover instead.

A mild flavored bonbon coating of natural light brown color. Adds a new piquant note to the character of bonbons; advances but does not dominate the flavor of the center.

COCOANUT CENTER FOR LICORICE BONBONS

Fresh Grated Cocoanut	55 lb.
Corn Syrup (43°)	35 lb.
Cane Sugar	15 lb.
Table Salt	¼ oz.

Put all of the above ingredients in steam kettle and cook to a soft ball. Add 10 pounds of nougat cream and 4 ounces vanilla extract. Pour on marble, let cool; cut or roll to size desired. Fork-dip in licorice bonbon coating.

A delicious fresh cocoanut bonbon for the high-class retail trade. A less perishable center can be made using desiccated instead of fresh cocoanut.

LOW-PRICED WRAPPED LICORICE CARAMELS (NATURAL COLOR OR COLORED)

Corn Syrup (43°)	60 lb.
Cane Sugar	40 lb.
Cocoanut Butter (92°)	8 lb.
Full Cream Caramel Paste	25 lb.
Whole Sweetened Condensed Milk	25 lb.
Vanilla Extract	4 oz.
Licorice Syrup	8 lb.

Put all the ingredients except licorice syrup and vanilla extract in kettle. Cook to a soft ball. Add licorice syrup and vanilla extract. Add black color if desired. Cook to a hard ball in cold water. Pour on slab and allow to stand overnight. Cut and wrap.

An inexpensive caramel of excellent stand-up and eating qualities.

LICORICE WRAPPED KISSES (SEMI-NOUGAT TYPE)

Corn Syrup (43°)	20 lb.
Cane Sugar	10 lb.
Cocoa Butter	¾ lb.
Whole Sweetened Condensed Milk	1¼ lb.
Licorice Syrup	1½ lb.
Color	Sufficient

Put all materials together in kettle. Cook to 255° F., pour on slab and let cool. Pull for five minutes, spin out and cut to suit.

A pleasing departure from the ordinary run of wrapped kiss formula, this licorice kiss is inexpensive to make, will stay soft, and is easy to eat.

ALMOND LICORICE NOUGAT

Cane Sugar	80	lb.
Corn Syrup (43°)	70	lb.
Almonds	15	lb.
Egg Albumen (Good Beating Quality)	1¼	lb.
Licorice Syrup	10	lb.
Water	8	gal.

Soak egg albumen in water overnight. Then put in nougat kettle and beat 5 minutes. Cook sugar, corn syrup, and water to 240° F. Take 3 quarts of this mixture and beat into egg fluff very slowly. Cook balance of sugar and corn syrup batch to 300° F. Add slowly to batch in nougat kettle until all are thoroughly mixed. Now add licorice syrup, almonds, and sufficient vegetable color to get a good black color.

If a short nougat is desired, the batch should be beaten about one-half hour. If a chewey nougat is preferred, 15 minutes beating will be sufficient.

Turn out nougat into steel or wood trays and cut the following day.

This makes a high-class cut nougat which is without equal for adding color contrast and flavor variety to pallid vacation numbers, summer packages, and straight nougat assortments.

GENUINE LICORICE "ANTHRACITE"

Licorice Syrup	12	lb.
Granulated Cane Sugar	50	lb.
Corn Syrup (43°)	60	lb.
Hard Fat (hydrogenated peanut or cottonseed stearine)	2	lb.
Whole 8% Sweetened Condensed Milk	5	gal.
Salt	½	lb.
Cocoanut Butter (92° m.p.)	6	lb.

Put all raw materials in kettle, with the exception of licorice syrup, and cook to a crack. Add licorice syrup and black vegetable color to suit. Cook to a hard crack. Pour on marble slab and allow to cool. Cut into irregular chunks resembling coal.

A rich, delicious-eating piece of the butter-toffee variety. Has the novel appearance of anthracite and a savory background of licorice.

GENUINE LICORICE "BLACK BIRDS"

Cane Sugar	12 lb.
Refined Dextrose (Corn Products "Cerelose" or equivalent)	20 lb.
Corn Syrup (43°)	30 lb.
Thin Boiling Starch	9 lb.
Gelatine	3¾ lb.
Licorice Syrup	5 lb.

Dissolve cane sugar, dextrose, and corn syrup in 4½ gallons of water. Cook as for a regular high-cooked gum drop. Suspend 9 pounds of thin boiling starch in 2 gallons of water and add gradually to the boiling batch. The cooking is continued until a high-cooked gum drop will result when finished.

Dissolve 3¾ pounds of gelatin in 5½ quarts of water and warm up. Mix this in with the remainder of the batch toward the end of the boil. Finally, add licorice syrup and black vegetable color to suit.

It is customary to give this piece a high gloss after taking it out of starch.

The popular chewey black licorice drop in the appealing all-licorice flavor. Those desiring a still chewier drop will find that they can vary the above formula by adding to the gelatin solution an equal amount of gum arabic dissolved in water.

SUGAR COATING FOR CANDY

Cocoa Butter Substitute	35 lb.
Powdered Skim Milk	15 lb.
Powdered Sugar	50 lb.
Salt	2 oz.
Vanillin	½ oz.

This may be colored and flavored with oil soluble colors. After melting the cocoa butter substitute add the other materials gradually in a dough mixer and finally run over finishing rolls at a temperature of 110° F. In using, run on enrober at 104° F.

CHOCOLATE COATING

Cocoa Butter Substitute	28 lb.
Cocoa Powder	10 lb.
Skim Milk Powder	10 lb.
XXXX Powdered Sugar	52 lb.
Vanillin	½ oz.
Salt	2 oz.

Melt fat and mix thoroughly. May be used at a temperature of about 110° F. For summer use, add 2% cottonseed stearine (140° m.p.).

VANILLA MARSHMALLOWS

Water	3 qt.
Gelatin	15 oz.
Corn Syrup	15 lb.
XXXX Sugar	15 lb.

Dissolve gelatin in 3 quarts of hot water and set aside. Heat in kettle the corn syrup to 250° F., remove from heat, and while mixing add 15 pounds of XXXX sugar. Now pour into the batch through a strainer the 3 quarts of gelatin, work the whole lot together and flavor with vanilla. Transfer the batch to the marshmallow beater, and beat until good and stiff, then pour it on a slab previously powdered with XXXX sugar. Let stand 4 to 5 hours, then cut into marshmallow size. Press knife down and cut.

AGAR JELLY GUM DROPS

Agar-Agar	10 oz.
Sugar	18 lb.
Corn Syrup	8 lb.
Water	5 gal.
Corn Starch	1 lb.

Soak 10 ounces of agar in 4 gallons of water, overnight. In the morning cook up the agar for several minutes, and then strain into the sugar and corn syrup. Now bring the batch to a boil, while stirring. When the batch comes to a boil, add the 1 pound of corn starch made into a paste with 1 gallon of water. Cook the entire batch up to about 230° F. or to a stiff string and then cast in starch. Add color and flavor, after removing batch from the heat. For fruit flavors use 1 or 2 ounces of citric acid.

CHEWING GUM

CHEWING GUM BASES

a. Bubble Gum Base

Washed Pontianac Gum	425 lb.
Washed Gutta Katian	400 lb.
Washed Gutta Soh	75 lb.
Candelilla Wax	10 lb.

The mixed gums and wax are heated until the total batch contains only 8–9% moisture.

b. Stick Gum Base

Pontianac Gum	425 lb.
Gutta Katian	400 lb.
Gutta Soh	75 lb.
Candelilla Wax	60 lb.

NO. 1. BALL GUM

Base *b* (above)	22 lb.
Corn Syrup	48 lb.
Sugar	117 lb.
Chicle	3 lb.
Wax	1½ lb.
Caramel Paste	2½ lb.
Flavor	2⅔ oz.

NO. 2. PENNY STICK GUM

Base *a* (above)	40 lb.
Corn Syrup	40 lb.
Sugar	140 lb.
Flavor	30 oz.

NO. 3. BUBBLE GUM

Base *a* (above)	35 lb.
Pontianac Gum	5 lb.
Corn Syrup	45 lb.
Sugar	115 lb.
Flavor	28 oz.

ICE-CREAM POWDER

The perfect smoothener for ice-cream and other frozen preparations.

Powdered Sugar	48 lb.
Gum Acacia (White)	2 lb.
Gum Karaya	50 lb.

A PURE VEGETABLE COMPOUND

Which has the following advantages:

1. It can be used to advantage by manufacturers of the best grade of sherbets and ice-cream, as well as cheaper grades.
2. While containing no gelatin it can be used to replace gelatin entirely. In other words, no gelatin is necessary when ice-cream powder is used.
3. It will cause milk or cream to beat up to more than double their original volume.
4. It will make ice-cream stand up, preventing it from melting quickly, and giving it a firm substance. It prevents it from becoming snowy or rough and from shrinking in volume while being stored or shipped.
5. It renders all water ices smoother and richer.
6. It is an incomparable thickener.

DIRECTIONS FOR USE

Straight Cream	2 oz. to 10-gal. freezer.
¼ Milk and ¾ Cream	4 oz. to 10-gal. freezer.
⅔ Milk and ⅓ Cream	8 oz. to 10-gal. freezer.
Straight Milk	12 oz. to 10-gal. freezer.

The quantity of ice-cream powder noted should be thoroughly incorporated with the amount of sugar which is used with the batch of 10 gallons of ice-cream. Into this mixture sufficient straight milk or cream and milk combined should be stirred to make a smooth paste. To this paste the balance of the milk or milk and cream should be slowly added. Stir and mix constantly until the whole is dissolved. When dissolved freeze the batch in the usual way.

ICE-CREAM PREPARATION

Albumen	10 oz.
XXXX Sugar	80 oz.
Whole Dried Milk	10 oz.
Indian Gum	5 oz.
Vanillin	1½ oz.
or:	
Dried Milk	50 oz.
XXXX Sugar	50 oz.
Cream of Tartar	4.4 oz.
Sodium Carbonate	2 oz.
Vanillin	0.06 oz.

Package 4½ ounces = 127.5 grams.

Stir contents of the package into ½ pint (1 cup) cold milk. Stir until dissolved.

Whip ½ pint (1 cup) chilled whipping cream.

Add the dissolved Freeze-It to the whipped cream and mix.

Freeze.

CHOCOLATE ICE CREAM

Milk	32 oz.
Sugar	16 oz.
Flour	2 oz.
Salt	⅛ oz.
Eggs	4 oz.
Cream	32 oz.
Vanillin	¼ oz.
Unsweetened Chocolate	4 oz.

Heat milk and add flour, salt, and sugar. Stir thoroughly in double boiler for 20 minutes after batch is brought to a boil. After the mass thickens, add the beaten eggs and cook for 5 minutes longer with con-

stant stirring. Cool, add cream which has been whipped into a stiff paste, and then add the flavoring. Add the melted chocolate, previously mixed with a little sugar and warm milk to form a paste. Put in a refrigerator or pack in ice and salt until frozen.

ICE CREAM WITHOUT GELATIN

Butter Fat	12 lb.
Sugar (Granulated)	12 lb.
Cerelose (Corn Sugar)	4 lb.
Milk Serum Solids	11.75 lb.
Vanilla Flavor	to suit

WATER ICES AND SHERBETS

The figures are given on the basis of 100 pounds of mix, which is about 10½ gallons.

WATER ICE

Cane Sugar	25 lb.
Corn sugar	7 lb.
Agar (3.2 oz. or 90.6 g.)	0.2 lb.
Gum Tragacanth or Galagum C (6.4 oz. or 181.2 g.)	0.4 lb.
Water, Fruit, Fruit Acid, Flavor, and Color	67.4 lb.

Overrun 20 to 25%. Total yield 13 gallons.

SHERBET USING MILK

Cane Sugar	25 lb.
Corn Sugar	7 lb.
Agar (3.2 oz. or 96.6 g.)	0.2 lb.
Gum Tragacanth or Galagum C (3.2 oz. or 90.6 g.)	0.2 lb.
Whole Milk	50 lb.
Water, Fruit, Fruit Acid, Flavor, and Color	17.6 lb.

Overrun 25 to 30%. Total yield 13.5 gallons.

SHERBET USING CREAM MIX

Cane Sugar	25 lb.
Corn Sugar	7 lb.
Agar (3.2 oz. or 90.6 g.)	0.2 lb.
Gum Tragacanth or Galagum C (3.2 oz. or 90.6 g.)	0.2 lb.
Ice Cream Mix, without Sugar or Gelatin	10 lb.
Water, Fruit, Fruit Acid, Flavor, and Color	57.6 lb.

Overrun 25 to 30%. Total yield 13.5 gallons.

ORANGE WATER ICE
(For 10 Gal. Batch)

Granulated Sugar	21 lb.
Corn Sugar	7 lb.
Galagum C	3 oz.
Orange Juice (or Its Equivalent in Orange Flavor)	1 gal.

Citric acid to suit. Make up to 10 gallons with water. Takes no overrun.

ORANGE SHERBET
(10 Gal. Mix)

Cane Sugar	22½ lb.
Cerelose (Corn Sugar)	7½ lb.
Milk	4 gal.
Gelatin	11 oz.
Orange Concentrate	4 oz.

Citric acid and color to suit. Make up to 10 gallons with water.

COCOA JUNKET

Cocoa	2 oz.
Boiling Water	4 oz.
Sugar	4 oz.
Milk	32 oz.
Junket Tablets	2
Cold Water	1 oz.
Vanilla Extract	¼ oz.

Cook mixture of cocoa and water in double boiler for 5 minutes. Add sugar, stir until dissolved, and then add milk which has been previously preheated to 100° F. Add vanilla extract and heat to 120° F. Stir in junket tablets which are dissolved first in a little water. Pour into containers immediately, let stand until set.

BRITISH UNWRAPPED CARAMELS

Condensed whole milk (40% sugar)	50 lb.
Dairy butter (salted)	5 lb.
Hard coconut butter (88-90° melting point)	10 lb.
Corn syrup	20 lb.
Nulomoline	5 lb.
Brown sugar	10 lb.
Rice flour	5 lb.
Salt	3 pounds

Flavor with a combination of:

Vanilla flavor	strong
Maple flavor	moderately strong
Violet flavor	trace

Place the condensed milk, butter, coconut butter, corn syrup, and Nulomoline into a kettle, heat, and mix until the fats are melted. Add the sugar and rice flour, mix, and boil the batch to a firm ball. Now add the salt and flavors, mix well and spread the batch out to cool, then size and cut.

NORTH CAROLINA CARAMELS

(For Caramel Twirls)

Part No. 1

Condensed skim milk (40% sugar)	35 lb.
Corn syrup	50 lb.
Coconut oil (76° melting point)	5 lb.
Nulomoline	10 lb.
Fine granulated sugar	20 lb.
Soft winter wheat flour	10 lb.
Salt	6 oz.
Basic fondant	15 lb.
Flavor and color	As desired

Heat the Nulomoline, corn syrup, milk and coconut oil, then add the sugar (which has first been mixed with the flour) and stir and cook the batch to a hard ball. Add the fondant, salt, flavor and color and mix well, then spread the batch out to cool.

Roll the batch into thin sheets, placing a layer of nougat (New York Nougat) on the caramel, then roll it up in much the same manner as jelly rolls. Spin the caramel into strips about 1 inch in diameter and later cut into pieces of the desired size.

BASIC FONDANT

Fine granulated sugar	80 lb.
Corn syrup	20 lb.
Nulomoline	10 lb.
Water to dissolve the sugar	

Cooked together to 244 degrees F.

SMYRNA CARAMELS

Corn syrup	10 lb.
Nulomoline	10 lb.
Coconut oil (76° melting point)	5 lb.
Sugar	15 lb.
Condensed whole milk (40% sugar)	20 lb.
Salt	4 oz.
Ground figs	30 lb.
Red color	
Roman Punch flavor	

Heat the corn syrup, Nulomoline, coconut oil and condensed milk together, then add the sugar, continue to stir and bring the batch to a boil. Now add the ground figs and cook to a firm ball; then add the salt, flavor and color. Spread the batch out to cool, then cut into squares, and wrap in cellophane or coat in chocolate or pack in parchment paper cups.

SWISS CARAMELS

(Unwrapped)

Sugar	45 lb.
Nulomoline	5 lb.
Corn syrup	40 lb.
Cream (20% butter fat)	100 lb.
Egg whites (fresh or frozen) or 2 pounds of albumen dissolved in 4 pounds of water	10 lb.
Salt	2 oz.
Coffee flavor	

First mix the egg whites or albumen solution with the cream. Meanwhile, place the sugar, Nulomoline and corn syrup into a kettle, add enough of the cream to dissolve the sugar and bring the batch to the boiling point. Gradually add the balance of the cream and egg mixture and boil the batch to a medium firm ball. Add the salt, flavor, and color if wanted, and spread the batch out to cool. Different flavors and nut meats can be added to this batch to produce a variety of caramels.

BUTTERSCOTCH

(Squares and Slabs)

Refined sugar	10 lb.
Brown sugar	10 lb.
Corn syrup	10 lb.
Nulomoline	5 lb.
Water	6 lb.
Dairy butter (salted)	3 lb.
Coconut oil (76° melting point)	2 lb.
Lecithin	½ oz.
Special caramel paste	10 lb.
Frappe—No. 1	2 lb.
Salt	3 oz.
Vanilla flavor	strong
Bergamot oil	trace
Nutmeg oil	trace

Melt the butter and coconut oil, add the lecithin and stir until it is melted, then add the sugars, corn syrup, Nulomoline and water and boil together to 280 degrees F.; then gradually add the caramel paste, mix well and continue to cook the batch to the first crack. Turn off the heat, add the frappe, salt and flavors and spread the batch out between iron bars so that it will be approximately ½ inch thick. Mark with a cutting frame, then cut into bars. This makes a good five-cent item for wrapping in waxed paper or cellophane.

SPECIAL CARAMEL PASTE

Corn syrup	35 lb.
Condensed whole milk (40% sugar)	45 lb.
Coconut oil (76° melting point)	10 lb.
Granulated sugar	20 lb.
Salt	½ lb.

Heat the corn syrup, coconut oil and condensed milk, add the sugar and salt and heat until the sugar is dissolved, then cook to a soft paste and spread out to cool.

Frappe No. 1

Nulomoline	50 lb.
Corn syrup	50 lb.
Albumen—dissolved in	1 lb.
Cold water	2 lb.

Boil the corn syrup to approximately 245 degrees F. Shut off the steam, add the Nulomoline (cold) and stir until the latter is melted. Place the batch in a marshmallow beater, start the beater, then gradually add the albumen solution and beat until light.

FRENCH CHEWING CANDY

Mixture No. 1

Corn syrup	25 lb.
Nulomoline	25 lb.
Albumen—dissolved in	3 lb.
Water	6 lb.

Boil the corn syrup to 245 degrees F., add the Nulomoline and stir until it is melted. Place the batch into a beater, start the beater then gradually add the albumen solution and beat until light.

Mixture No. 2

Sugar	30 lb.
Nulomoline	5 lb.
Corn syrup	25 lb.
Cream (20% butter fat)	10 lb.
Coconut oil (76° melting point)	2 lb.

Boil altogether to 290 degrees F., pour this into 20 pounds of Mixture No. 1, adding 6 ounces of gelatine that has been previously soaked in 6 ounces of hot water, and beat until quite light. Now add 10 pounds of roasted cashew nuts, 2 pounds of unsweetened chocolate and vanilla flavor. When the batch is almost cold, spin it into round sticks about 1½ inches in diameter, then cut these sticks or rolls into pieces approximately 6 inches long and wrap in cellophane or heavy waxed paper. This may also be cut into blocks or bars.

JAPANESE STRIPS (Coconut Pieces)

Corn syrup	20 lb.
Water	8 lb.
Brown sugar	5 lb.
Nulomoline	5 lb.
Condensed whole milk (40% sugar)	10 lb.
Coconut oil (76° melting point)	3 lb.
Desiccated coconut	25 lb.
Salt	2 oz.
Red color	
Oil of cinnamon (Ceylon)	
Currants	7 lb.

Heat the corn syrup, water, Nulomoline, sugar, condensed milk and coconut oil to the boiling point. Add the coconut, continue to mix and cook to a medium firm paste, then add the color, salt, and flavor, mix well, then add the currants. Mix and spread out to cool on an oiled slab dusted with XXXX sugar, then roll the batch down and, when cold, size, cut and roll in sugar.

MANDARIN SLICES (Coconut Cut Pieces)

Sugar	15 lb.
Water	10 lb.
Nulomoline	10 lb.
Corn syrup	25 lb.
Desiccated coconut	25 lb.
Kumquat pieces	10 lb.
Preserved ginger	4 lb.
Yellow color	

Heat the sugar, water, Nulomoline and corn syrup to the boiling point, then add the coconut and stir and cook to a medium firm paste. Add the kumquat pieces, ginger and color, and mix well. If the fruit contains an excess amount of water, cook the batch to a firm paste.

Spread the batch out on an oiled slab dusted with XXXX sugar and, before the batch is quite cold, form into rolls about one inch in diameter. When cold moisten the rolls with simple syrup or thin icing and roll at once in sesame seeds. The rolls may later be cut into slices and placed in paper cups.

MONT ROYALE
(Fudge Coconut Kisses)

Mixture No. 1

Desiccated coconut (fancy shred)	50 lb.
Nulomoline	5 lb.
Hot water	5 lb.

Mix the Nulomoline with the hot water, then mix it through the coconut and allow to set for one-half hour before using.

Mixture No. 2

Condensed whole milk (40% sugar)	35 lb.
Corn syrup	25 lb.
Nulomoline	15 lb.
Brown sugar	15 lb.
Coconut oil (76° melting point)	9 lb.
Salt	8 oz.
Winter wheat flour	5 lb.
Basic fondant—made from:	100 lb.
80 lbs. sugar	
20 lbs. corn syrup	
10 lbs. Nulomoline	
Water to dissolve the sugar	
cooked to 244° F.	

Heat the condensed milk, corn syrup, Nulomoline and coconut oil together, add the sugar and flour and continue to stir and cook the batch to a firm ball, then add the salt, fondant and vanilla flavor and mix well. Now add the coconut (Mixture No. 1), mix well and spoon the batch out into roughly formed kisses, or it may be formed into bars or egg shapes and coated in chocolate.

SICILANO COCONUT CUTS (Licorice Flavor)

Sugar	12 lb.
Nulomoline	8 lb.
Corn syrup	20 lb.
Water	8 lb.
Coconut oil (76° melting point)	2 lb.
Licorice paste (properly dissolved)	3 lb.
Desiccated coconut	25 lb.
Gelatine—soaked in 8 ounces of water	8 oz.
Salt	1 oz.
Black color	
Anise flavor (optional)	
Almonds	4 lb.

Heat the sugar, Nulomoline, corn syrup and water to the boiling point, add the properly dissolved licorice paste, then the coconut and stir and cook the batch to a medium firm paste. Now add the soaked gelatine, salt, coconut oil, color, flavor and almonds and mix well. Spread the batch out on an oiled slab dusted with XXXX sugar that has first been colored black. Roll the batch down to the desired thickness using colored XXXX sugar, and when cold cut into pieces.

MASSACHUSETTS MOLASSES MINT CREAM CENTERS (Short-Cast Cream Centers)

Mixture No. 1

Basic fondant—made from:	100 lbs.
Sugar	80 lbs.
Corn syrup	20 lbs.
Nulomoline	10 lbs.
Water to dissolve the sugar	enough
Cooked together to 242° F.	

Mixture No. 2

Grandma's Molasses (Dark)	25 lb.
Sugar	20 lb.
Water	5 lb.
Frappe—No. 1	15 lb.
Convertit	2 oz.
Mint flavor	Sufficient

Place the fondant (Mixture No. 1) into a cream melting kettle and heat the batch to approximately 120 degrees F. Meanwhile, boil the molasses, sugar and water to 234 degrees F., then pour this at once on top of the fondant and mix thoroughly. Now add the frappe and convertit, mix well, then work in the flavor. The casting temperature is approximately 140–145 degrees F.

Frappe—No. 1

Nulomoline	50 lb.
Corn syrup	50 lb.
Albumen—dissolved in	1 lb.
Cold water	2 lb.

Boil the corn syrup to approximately 245 degrees F. Shut off the steam, add the Nulomoline and stir until melted. Place the batch in a marshmallow beater, start the beater, then gradually add the albumen solution and beat until light.

PENNSYLVANIA PUDDING (Cast Whipped Creams—Chocolate Flavor)

Mixture No. 1

Sugar	80 lb.
Corn syrup	20 lb.
Nulomoline	10 lb.
Water	20 lb.

Boil together to 242 degrees F., then cool to 110 degrees F., and beat into fondant in the usual manner.

Mixture No. 2

Corn syrup	50 lb.
Nulomoline	50 lb.
Good grade gelatine—soaked in	1½ lb.
Cold water	3 lb.
Albumen—soaked in	1½ lb.
Cold water	3 lb.

Boil the corn syrup to 245 degrees F., add the Nulomoline and stir until it is melted. Place the batch in a marshmallow beater, add the gelatine solution, start the beater, then gradually add the albumen solution and beat until quite light.

Process: Melt 100 pounds of fondant (Mixture No. 1) to 150 degrees F., add 5 pounds of unsweetened chocolate, 2 ounces of salt and vanilla or rum flavor and mix well; then add 30 pounds of frappe (Mixture No. 2) and mix well. Cast the batch into starch, at 140–145 degrees F. This is suitable for small or large pieces.

VIRGINIA VARIETY CREAMS (Crystallized Creams)

First prepare a fondant as follows:

Sugar	80 lb.
Corn syrup	15 lb.
Nulomoline	5 lb.
Water to dissolve the sugar	

Boil altogether to 246 degrees F. and cream as usual.

Prepare a bob as follows:

Sugar	80 lb.
Corn syrup	10 lb.
Nulomoline	5 lb.
Water to dissolve the sugar	

Boil together to 245 degrees F.

Place 100 pounds of the fondant in a clean cream melting kettle, turn the steam on partly and heat the fondant to approximately 125 degrees F., then add color and flavor and mix well.

Now gradually add the boiled bob and mix thoroughly.

Have the hopper of the depositor heated to approximately 125 degrees F.

Cast into fancy shaped starch impressions and later crystallize the creams using a syrup of 34 Baume—temperature 75 degrees F.

ITALIAN CREAM FUDGE

Mixture No. 1

Sugar	80 lb.
Nulomoline	20 lb.
Cream (26% butter fat)	20 lb.

Place the sugar, Nulomoline and 15 pounds of the cream into a kettle, stir the batch constantly until it boils, then wash down all grains of sugar that adhere to the interior of the kettle. Now add the remaining cream and boil the batch to 240 degrees F. Pour the batch onto a cream cooler and do not disturb until it has cooled to approximately 110 degrees F., then beat into fondant in the usual manner.

Mixture No. 2

Sugar	50 lb.
Corn syrup	20 lb.
Condensed whole milk (40% sugar)	40 lb.
Hard coconut butter (86° melting point)	14 lb.
Salt	10 oz.
Frappe—No. 1	10 lb.
Vanilla flavor	

Place the condensed milk, corn syrup and coconut butter into a kettle and heat until the fat is melted, then add the sugar and stir and cook to 240 degrees F. Turn off the heat, add the salt, flavor, nuts as desired, and frappe; add 100 pounds of Mixture No. 1, and mix thoroughly, then spread the batch out on oiled paper to set.

Frappe—No. 1

Nulomoline	50 lb.
Corn syrup	50 lb.
Albumen—dissolved in	1 lb.
Cold water	2 lb.

Boil the corn syrup to approximately 245 degrees F. Shut off the steam, add the Nulomoline (cold) and stir until the latter is melted. Place the batch in a marshmallow beater, start the beater, then gradually add the albumen solution and beat until light.

GEORGIA GUM DROPS (Starch Jelly Gums)

Sugar	40 lb.
Nulomoline	10 lb.
Corn syrup	50 lb.
Corn starch (No. 50-60)	10½ lb.
Cold water	100 lb.
Cream of tartar	2 oz.

Place the water, sugar, starch and 30 pounds of the corn syrup in a kettle equipped with a good stirring device. Turn the steam on partly and allow the batch gradually to reach the boiling point. Add the cream of tartar, turn the steam on full and boil the batch as rapidly as possible, using 80 to 100 pounds steam pressure. Cook the batch to a string, turn off the heat, add the balance of the corn syrup and the Nulomoline, then

color and flavor, mix thoroughly and cast the batch into starch. (The temperature of the starch into which the jellies are cast may range from 65 to 175 degrees F.)

If a continuous starch drier is available, heat the starch to 160–175 degrees F., then cast the batch into the starch and leave the jellies in a room at normal temperature for at least ten hours. They may then be removed from the starch, moistened with steam vapor and sanded with fine granulated sugar.

In the absence of a continuous starch drier the jellies may be placed in a drying room, heated to 140 degrees F., and allowed to dry for 24 to 48 hours.

MOSCOW JELLIES (Cut Agar-agar Jellies)

Mixture No. 1

Sugar	30 lb.
Nulomoline	20 lb.
Water	40 lb.
Japanese gelatine (agar-agar No. 1.)	1 lb.

Mixture No. 2

XXXX Sugar (berry sugar)	25 lb.
Green coloring	
Peppermint and caraway oils	Combination

Mixture No. 1: Soak the agar-agar in the water for several hours (preferably, over-night), then boil the agar-agar and water for several minutes, stirring occasionally. Strain the agar solution through a No. 30 sieve, add the sugar and Nulomoline and boil to 222 degrees F.; allow the batch cool to 140 degrees F.

When the batch has cooled to 140 degrees F., add the color, flavors and XXXX sugar and mix well, pouring the batch into trays which have first been lined with ordinary wrapping paper.

When the jelly has set, sprinkle the surface with XXXX sugar, remove the paper from the jelly sheets, sprinkle them well with XXXX sugar and cut into pieces of the desired size, then sand well and let them dry before packing.

SWAN MARMALADE (Cast)

Apricot Starch Jellies

Dry apricots—soaked in water until soft	20 lb.
Sugar	50 lb.
Nulomoline	10 lb.
Corn syrup	40 lb.
Starch No. 50-60	10 lb.
Cream of tartar	1 oz.
Water	90 lb.
Red coloring	

Rub the apricots through a No. 20 sieve to remove the skins, then place the apricot pulp in a kettle, add the sugar, Nulomoline, corn syrup, starch, water and cream of tartar and boil altogether to a good string. Add the red coloring, mix well and cast the batch into warm, dry starch.

Place the jellies in a dry room at 130 degrees F. for 24 hours and when cold, remove from the starch, run them through a sanding machine and sand them in granulated sugar which has been colored yellow.

NEW JERSEY JELLY (Agar Jelly for Cutting or Casting)

Sugar	50 lb.
Corn syrup	25 lb.
Nulomoline	25 lb.
Japanese gelatine No. 1 (agar-agar)	1¾ lb.
Water	75 lb.
Flavor and color—as desired	

Soak the gelatine in the water for at least two hours (preferably overnight). Place the soaked gelatine in a kettle and boil for several minutes, stirring occasionally, then strain through a No. 30 sieve. Add the sugar and Nulomoline to the strained gelatine and boil the batch to 224 degrees F. Turn off the heat, add the corn syrup, mix well, and when the batch has cooled to approximately 125 degrees F., add flavor and color. The batch may now be poured into trays that have been lined with wrapping paper or cast into warm, dry starch.

If the jelly is poured into trays, allow it to remain undisturbed until set, then turn the jelly sheet up-side down. Moisten the paper with water, peel off the paper and roll the jellies in XXXX sugar, then cut and roll again in XXXX sugar and let the pieces dry before they are packed into containers.

If aerated jelly is desired, as soon as the batch has boiled to 224 degrees F., place it at once in a marshmallow beater, start the beater, then gradually add ½ pound of albumen, dissolved in 1 pound of water, and beat the batch until white.

Acid or flavors containing acid should be added when the batch has cooled to 125 degrees or less.

TURKISH PASTE (Starch Jellies—Cast into Starch)

Sugar	55 lb.
Nulomoline	45 lb.
Thin boiling starch No. 50-60	12 lb.
Water	100 lb.
Cream of tartar	2 oz.
Color and flavor—as desired	

Place the sugar, Nulomoline, water, starch and cream of tartar into a kettle and cook and stir the batch occasionally until it reaches the boil-

ing point. Continue to stir and boil the batch to a good string. Turn off the heat, add color and flavor and cast the batch into dry starch.

Place the jellies in a drying room over-night, then remove the jellies from the drying room and clean well. Run them through a sanding machine and, when the jellies are quite dry, they are ready to be packed.

DELAWARE DESSERTS (Plain Marshmallow)

First grade gelatine	2½ lb.
Water	32 lb.
Fine granulated sugar	60 lb.
Corn syrup	40 lb.
Nulomoline	10 lb.

Mix the gelatine with 17 pounds of cold water. Place the remaining 15 pounds of water in a kettle and add the sugar. Heat and stir until the sugar is dissolved (do not boil), then add the soaked gelatine and stir until it is dissolved. Now add the corn syrup and Nulomoline and beat the batch until 1 gallon measure filled with the marshmallow weighs approximately 4 pounds. Add the flavor, mix well and place the batch into the hopper of the depositor, which should be heated to approximately 100 degrees F.

Cast the marshmallow into starch, containing not more than 8% of moisture and heated to 90–95 degrees F. Place the trays containing the marshmallow in a room at normal temperature for 10–20 hours.

After a slight crust has formed on the marshmallows, remove them from the starch. If they are to be packed plain, dust them with a combination of 9 pounds of dry powdered sugar to 1 pound of dry starch. Let them remain covered with the starch-sugar mixture for several hours before packing.

These marshmallows can also be placed in a revolving pan and coated with colored and flavored jelly (made by formula for New Jersey Jelly). After the marshmallows are well coated with the jelly, add desiccated coconut or colored sugar and turn them out to set.

MARYLAND MARSHMALLOW (Toasted Coconut Cut Marshmallow)

Granulated sugar	25 lb.
Nulomoline	15 lb.
Corn syrup	60 lb.
Water	18 lb.
Good grade gelatine	2½ lb.

Soak the gelatine for at least 15 minutes in 10 pounds of cold water.

Meanwhile, heat the sugar with the remaining 8 pounds of water until the sugar is dissolved. (Do not permit the batch to boil.) Turn off the heat, add the Nulomoline and soaked gelatine and stir until the gelatine

is completely dissolved, then add the corn syrup. Place the batch in a beater and beat until quite light. Add flavor and color as desired, spread in paper lined or greased trays, and immediately sprinkle the surface with toasted coconut.

When the marshmallow has set, cut it into squares or bars and roll in toasted coconut. Permit the bars to dry for several hours before packing.

DANSKE NUGA (Fluffy Short Nougat)

Part No. 1

Albumen—dissolved in	12 oz.
Water	2 lb.
Tapioca flour	12 oz.
Grandma's molasses	4 lb.

Place the albumen solution, tapioca flour and Grandma's Molasses in an upright beating bowl and beat until rather stiff.

Part No. 2

Sugar	35 lb.
Corn syrup	15 lb.
Nulomoline	5 lb.
Water	8 lb.

Boil altogether to 245 degrees F. Add 2 gallons of this syrup to Part No. 1, beating at second speed. Boil the remainder of the syrup batch to 250 degrees F., gradually add this to the beaten batch, and continue the beating until quite light. Add 2 ounces of powdered sugar to start the grain when making the first batch.

When grain becomes visible add 5 pounds of powdered skimmed milk, 3 pounds of hard coconut butter (88 degrees melting point), 2 ounces of salt, vanilla flavor and broken walnut pieces.

Spread the batch out on an oiled and dusted wood or metal slab and, when it has set, cut into bars of the desired size, and coat with chocolate or icing.

MONTELEMAR NOUGAT

Mixture No. 1

Honey	10 lb.
Corn syrup	10 lb.
Nulomoline	10 lb.
Albumen—dissolved in	3½ lb.
Water	7 lb.

Heat the Nulomoline, honey and corn syrup until they are melted, place this into a beater, gradually add the dissolved albumen, and beat until quite light.

Mixture No. 2

Corn syrup	40 lb.
Sugar	60 lb.
Nulomoline	10 lb.
Water	15 lb.
Coconut oil (76° melting point)	2 lb.
Salt	4 oz.
Orange flower flavor	
Vanilla flavor	
Pistachio nuts	10 lb.
Blanched almonds	15 lb.
Lightly roasted almonds	10 lb.

Boil the corn syrup, sugar, Nulomoline and water to 280 degrees F., pour this gradually into Part No. 1, beating well. Add the flavors, salt, nuts and coconut oil and mix well; then spread the batch on an oiled slab and, while warm, cut into bars.

NEW YORK NOUGAT

Mixture No. 1

Albumen—dissolved in	2 lb.
Water	4½ lb.

Beat until light, then place in a cold kettle.

Mixture No. 2

Sugar	75 lb.
Corn syrup	50 lb.
Water	16 lb.

Cook altogether to 245 degrees F. Draw off about 25 pounds of the syrup, and pour it slowly into the beaten albumen, stirring constantly.

Cook the remainder of the batch (Part No. 2) to 270 degrees F., and add this to the beaten batch and beat until grain is visible, then add Part No. 3.

Mixture No. 3

Nulomoline	10 lb.
Corn syrup	10 lb.

Boil together to 265 degrees F. Pour this into the beaten batch, also adding 3 pounds of coconut butter, 4 ounces of salt, flavor, nuts or diced fruits, and mixing well. Spread the batch out on an oiled slab to set.

This makes an ideal layer to be used between caramels or coconut work. It may also be wrapped plain or coated in chocolate.

ENGLISH TOFFEE NOUGATS (Chewing)

Corn syrup	38 lb.
Nulomoline	10 lb.
Dairy butter (salted)	5 lb.
Coconut butter (86° F. melting point)	10 lb.
Condensed whole milk (40% sugar)	40 lb.
Brown sugar	15 lb.
Fine granulated sugar	20 lb.
Salt	5 oz.

Flavor with a combination of clove oil, almond oil and vanilla.

Place the following ingredients in a caramel cooking kettle: Nulomoline, corn syrup, butter, coconut butter and condensed milk. Give the steam valve a couple of turns and allow the batch to mix until the fats are melted and mixed with the other ingredients. Then add the brown and white sugar, turn the steam on full and cook the batch as rapidly as possible to a firm ball.

This toffee can be cooked quite successfully, using as much as 110 pounds of steam pressure. After the batch has been cooked to the desired consistency, turn off the heat, add the salt and flavor and mix thoroughly. Spread the batch out at once to cool, then gradually fold it together so as to secure an even temperature throughout the batch. It is then ready to pass through drop rolls.

After the toffee nuggets are cold, place them in a revolving pan, spray them well with melted hard coconut butter, then add powdered sugar that has first been flavored with mint oil. Allow the candies to revolve until they are well coated, spread them out to set, then pack.

RUM-BUTTER TOFFEE (Wrapped)

Condensed whole milk (40% sugar)	40 lb.
Corn syrup	30 lb.
Nulomoline	10 lb.
Grandma's Molasses	5 lb.
Fine granulated sugar	30 lb.
Hard coconut butter—No. 90	15 lb.
Salt	5 oz.
Rum and butter flavor	

Place the condensed milk, corn syrup, Nulomoline, molasses and hard coconut butter into a caramel cooking kettle, equipped with double action mixers. Turn the heat on partly and mix the batch until the fat is completely melted, then add the granulated sugar, mix well, turn the steam on full and boil the batch as rapidly as possible to a medium firm ball. Turn off the heat, add the salt, then the rum-butter flavor and mix thoroughly.

Spread the batch out to cool, then cut into pieces of the desired size and wrap.

BARCELONA BRITTLE (Chocolate Flavored)

Sugar	15 lb.
Water	4 lb.
Nulomoline	3 lb.
Corn syrup	2 lb.
Dairy butter (salted)	3 lb.
Condensed whole milk (40% sugar)	4 lb.
Coconut oil (76° melting point)	7 lb.
Unsweetened chocolate	2 lb.
Lecithin	2 oz.
Salt	2 oz.
Ground roasted almonds	5 lb.
Ground roasted filberts	5 lb.

Place the coconut oil and chocolate into a kettle and heat until melted, add the lecithin and mix until it is dissolved, then add the sugar, Nulomoline, corn syrup, water, butter and condensed milk and cook the batch to 300 degrees F. Now add the ground roasted nuts, mix thoroughly and turn the batch out on an oiled slab, then roll as thinly as possible and cut into squares.

It is also possible to grind this brittle roughly and work it into ice cream or use it as a topping for sundaes. It can also be worked into chewing nougat to replace fruits, nuts, etc.

GLASGOW CRACKLE

Sugar	15 lb.
Nulomoline	3 lb.
Salted dairy butter	2 lb.
Coconut oil (76° melting point)	8 lb.
Lecithin	1½ oz.
Water	2 lb.
Ground roasted peanuts (maximum amount)	
Salt	2 oz.
Rum butter flavor	

Melt the dairy butter and coconut oil, add the lecithin and stir until it is melted, then add the sugar, Nulomoline and water and boil altogether to 310 degrees F. Now add the maximum amount of ground roasted peanuts, then the salt and flavor, and mix well.

Spread the batch out on an oiled slab and roll into a thin sheet and cut with a roller knife.

This piece may be coated in chocolate or wrapped in cellophane or waxed paper, and used either for packages or bars.

It is also possible to grind this candy roughly and work it into ice cream or use it as a topping for sundaes. It may also be worked into chewing nougat to replace fruits, nuts, etc.

CHAPTER V

CACAO, CHOCOLATE PRODUCTS,* COFFEE AND TEA

Cacao is derived from the seeds of Theobroma CACAO. The cacao (often incorrectly called cocoa) tree is indigenous to Brazil, Venezuela, Ecuador, and Mexico, thriving only in tropical climate in localities that have well-watered, well-drained soils, and plenty of rainfall. It is a medium-sized tree, 20 to 30 feet high. The fruit is a pod, having a hard, thick shell, and is from 8 to 10 inches long and from 3 to 4 inches thick. There are some 40 or more beans in each pod.

DIFFERENT KINDS OF CACAO BEANS

Porto Cabello or Caracas

Large, but not very uniform in size.

Covered with a reddish, sometimes silver-gray dust.

The husks are thicker than on ordinary beans and are of dark red color inside. Ninety-nine hundredths of one per cent theobromine. The small Caracas bean has less fat and is therefore cheaper.

Trinidads

The beans are nearly flat, the husk is dark gray and the kernels almost black. Ninety-two hundredths of one per cent theobromine. A good bean for the price.

Guayaquils (Ecuador)

Large, flat, irregular shaped beans. Husk and kernel are brown. Fine strong flavor.

Cubans

Egg-shaped, flat beans. Husk mauve, kernel dark brown.

Paras (Brazil)

Irregular in size, long and flat on one side. Husk gray or reddish, the kernel light brown. Rich in fat, good for filler.

Grenadas

Similar to Paras.

* Courtesy of B. J. Zenlea, Food Industries, N. Y. City.

Javas

Oval, slightly flattened beans. The husk thin and easily peeled. The kernel is light brown, of bitter but agreeable taste. One and twenty-two hundredths per cent theobromine. Fine flavor, but high in price.

Bahias

Flat, triangular in shape, and rough. The yellow looking bean is the best, the grayish-red one inferior. The kernel is mauve in color and produces a dark liquor. A very popular bean in the United States.

TEST FOR RIPENESS OF A CACAO BEAN

Cut the bean with a knife. If it slices and no shell falls off, the bean is unripe.

THE (COCOA) CACAO BEAN AND ITS PRODUCTS

Cocoa has been cultivated since very ancient times, but this plant and its products were unknown to Europe until the beginning of the sixteenth century, when Cortez and his soldiers became acquainted with it upon their landing in Mexico. From then on the use of cocoa spread very rapidly throughout the civilized world, until today cocoa is of international usage.

Cocoa is grown almost entirely south of the Equator, the largest crops coming from the west (Gold Coast) of Africa. The next largest crop comes from Ecuador.

The cocoa from each country has a distinctive character and flavor of its own. The cocoas coming from Venezuela are the finest and the cheapest are from San Domingo.

Cocoa beans are the seeds of a tree that grows in most tropical countries. The seeds grow in pods very much like the seeds of the pumpkin and squash, and hang from both the branches and trunks of the trees. When ripe they are picked from the tree and gathered into large piles. They are then cut open and the seeds and pulp scraped out.

The seeds with their surrounding pulpy mass are placed into large vats or pits and allowed to ferment. The time of fermentation varies according to the kind of cocoa. The sweeter variety requires a shorter fermentation while the coarser or more ordinary type requires a longer fermentation.

During the fermentation starch is converted by the diastase present into soluble sugars, which are further fermented into alcohol, and finally converted to acetic acid. The pulpy mass is decomposed and flows away as a vinegar-smelling fluid. During the fermentation care must be taken that sufficient air is circulated through the beans, otherwise, if insufficient

oxygen is present butyl alcohols are formed which will give the cocoa a bad odor. To prevent this the beans are turned over every day. Fermentation changes the color of the bean from a light to a dark rich red brown, liberates the alkaloid theobromine, and lessens its bitter and astringent taste.

When the fermentation is completed the beans are separated from any remaining pulp, dried, and sometimes polished. The drying must be done very carefully, as improperly dried beans are apt to become moldy. The best cocoa is obtained by drying in the sun, although methods using steam- or water-heated pipes are also in use.

Upon importation into the United States, the beans are inspected and are rejected if they contain more than 5% of either wormy or moldy beans.

The raw cocoa beans are cleaned by passing them over a shaking-table covered with a metal screen which has holes smaller in size than the beans. Sand, dust, and other foreign materials are screened out. At the end of the shaking-table, the beans drop into a chute located at the bottom of an air duct. The cleaned beans are carried up by air suction, and deposited into a conveyor. Stones, metals, and other heavy materials drop to the bottom of the chute, which is counterpoised by a weighted lever. When sufficient heavy material has gathered, the bottom opens and the foreign material drops to a receiving pan.

The clean raw cacao beans are run into a roaster of approximately 600 pounds capacity, of the revolving drum type, which is heated by coal fire using forced draft, or by gas or superheated steam. A roast usually requires 45 minutes, depending on the type of cacao beans, and the kind of roast desired. The final flavor of the cocoa powder and chocolate depends a great deal on the proper roasting of the cacao beans.

The cacao beans attain a temperature from 240° to 300° F. at the end of the roast, are quickly discharged into a cooling truck with a perforated metal bottom, and are quickly cooled by sucking cold air through them.

The cooled beans are carried to a cracker and fanner device, which cracks up the beans and blows the shells aside. The cocoa germs and fines are separated from the broken nibs by sieving them through a rotating cylinder covered with screening of increasing mesh. The clean nibs are carried to hoppers which feed a battery of triple stone mills, and are ground into a heavy, viscous fluid known as chocolate liquor, and is the starting point in the manufacture of cocoa powder and chocolate.

In the manufacture of cocoa powder the chocolate liquor is transferred to hydraulic presses, and pressed from 8 minutes to 1¾ hours, depending on the amount of fat that is to be left in the cocoa powder. The cocoa

press cake is cooled, and broken up by a cracking device, passed over a magnetic belt to remove stray iron, and then put through a micro-pulverizer. The ground press cake is cooled on a conveyer, and refined by sieving through silk bolting cloth, or by playing a current of air on the particles of cocoa in such manner as to separate the fine cocoa from the coarse. The coarse cocoa, or cocoa tailings, are returned to the grinders and reground over and over again, until the particles are fine enough to pass through the sieve, or can be separated by air flotation.

There are many kinds of cocoas, but they can be divided into two main divisions, namely,

a. Natural process cocoa

b. Dutch process cocoa

Natural process cocoas are cocoas to which no alkalies or "Dutching Agents" have been added during manufacture.

Dutch process cocoas are cocoas to which an alkali has been added. In preparing Dutched cocoas, the clean nibs are boiled in a solution of alkali, such as potassium, sodium, ammonium bicarbonate, or carbonate. The water is evaporated and the Dutched nibs dried in a roaster. The nibs are milled, the liquor pressed, and the cocoa refined in the same manner as for natural process cocoas.

Dutched cocoas are darker in color, less acid, and less bitter than natural cocoas. They are more economical to use, and, for certain purposes, cannot be replaced by natural cocoas.

The various types of cocoas can be described as follows:

1. Semi-cocoas, cocoa nuggets, cocoa crumbles, cocoa chips, etc., are prepared by crumbling press cake or by mixing chocolate liquor with a quantity of cocoa to reduce the fat. In the latter case, the product is molded into thin cakes, and then broken into small chips. Because of the high fat content, 32 to 45%, and chocolaty flavor, they are used extensively for fine quality ice-cream, and for fancy icings.

2. High-quality cocoas usually contain from 25 to 32% cocoa butter. They are made from select quality cocoa beans of the better type, and are carefully blended. These cocoas are either Dutched, natural, or semi-Dutched. They are used for fancy ice-cream, for drinking, for icing, as a filler between layers of cakes, and for syrups.

3. Breakfast cocoas contain not less than 22% cocoa butter. The natural process and semi-Dutched breakfast cocoas are used for drinking, syrups, and general household use. The Dutched type breakfast cocoas are used for chocolate biscuits and crackers, for devil food cakes, and for home candy making, such as chocolate fudge.

4. Semidry cocoas usually contain 15 to 18% fat. The natural and semi-Dutched cocoas are used for malted milk mixtures, cocoa milk drinks, chocolate flavored desserts, chocolate pies, and chocolate flavored syrups. The percentage of fat they contain is just right for use in the products mentioned.

5. Dry cocoas contain 10 to 12% fat, and are used for miscellaneous purposes. The natural process cocoa is used for milk drinks, cocoa skim milk mixtures, sweet cocoas, icings, etc. The Dutch process cocoa is used for cocoa extracts, for baking, and devil food mixtures. These cocoas are the most common type found on the market, and are used where low cost is of importance.

6. Extra dry cocoas contain between 8 and 9% cocoa fat. They are used for thin syrups, and other mixtures where any excess fat is not desired.

7. Very dry cocoas contain 6½ to 7¾% fat, and this fat content is about the limit for cocoas made by pressing the fat from the chocolate liquor. They are used for making substitute or imitation chocolate coatings by incorporating sugar and another fat, such as cocoanut oil. They are desired for their low fat content, because of the difficulty of blending cacao butter and cocoanut oil. This cocoa is used as a dusting powder in confectionery.

8. Solvent-extracted cocoas or defatted cocoas contain from ½ to 3% fat. They are usually manufactured from cheap low-fat cocoa cake, by extracting the remaining fat by means of a solvent. Solvent-extracted cocoas have practically no chocolate flavor. Some have a faint odor and taste of the solvent used for their extraction. They are usually high in moisture content, running at times as high as 10%. Solvent-extracted cocoas are used as dusting powders in confectionery, and for imitation chocolate.

9. By-product cocoa and cocoa cake usually contain 5½ to 11% cocoa fat. This product is obtained by passing cocoa fines and dust through the Anderson Expeller, which removes a portion of the fat. The by-product cake has a limited use as a fertilizer ingredient, as raw material for theobromine extraction, and for cattle feed. Its use for the latter purpose is limited, and has not been very successful.

10. Prepared cocoas are cocoa mixtures, such as cocoa and sugar, cocoa skim milk and sugar, and cocoa malt skim milk and sugar. They are used for instant chocolate and milk drinks in ice cream parlors, and are also put up in envelopes of the proper weight sufficient for one cup.

MANUFACTURE OF CHOCOLATE

Chocolate, because of its irresistible flavor, its concentrated food value, pleasing appearance, keeping qualities, and convenience in handling, is prized by the young, the old, the athlete, the warrior, and the explorer.

The definition of chocolate, in a technical and restricted sense, is the solid or plastic mass obtained by grinding cacao nibs free from shell or husk and germs, and is the product commonly known as chocolate liquor. By common usage, however, the word chocolate is usually applied to sweet chocolate, milk chocolate, and chocolate covered centers.

Although chocolates may be similar in composition as to percentages of chocolate liquor, sugar, added cocoa butter, and milk solids, there is a world of difference in their flavor and texture.

There are many varieties of cocoa beans, of which approximately thirty are used in the larger chocolate factories. The cocoa beans vary as to color, chocolate character, pungency, acidity, mildness, bitterness, and creaminess. The delicate flavors of the cocoa beans are developed by careful roasting, cleaning, and milling. The flavor of the resulting chocolate is dependent upon the skill used in blending, milling, and conching the various varieties of cocoa nibs with the proper amount of sugar and cocoa butter, with or without milk solids, and flavors.

The possibility of developing blends of chocolate is unlimited. Most formulae are limited to blends of one to six varieties. The number of combinations that can be made with thirty varieties of cocoa beans blended with varying percentages of sugar, cocoa butter, milk solids, and flavors, and milled to various degrees of fineness, and adjusted to various viscosities and colors, is astounding.

There are many varieties of chocolates on the market, but they can be classified into the following general types: Bitter, bittersweet, dark sweet, medium dark sweet, light sweet, milk chocolate, ice-cream coating, skim milk, buttermilk, malted milk, imitation, and lecithin coatings.

It is difficult to state exactly what type of chocolate coating is best suited for a particular center. It depends on a number of factors among which are sweetness, texture, and blending properties of both the center and coating. As a rule chocolate liquors and bittersweets are used for every sweet center. Dark sweets and medium dark sweet coatings are used for moderately sweet centers. Milk chocolates are used for caramels, nougatines, marshmallows, etc. Light sweets are used for centers not too sweet and for candy bars.

The chocolate liquor of commerce is also known as chocolate, bitter chocolate, chocolate liquor, chocolate paste, bitter chocolate coating, and unsweetened chocolate. It is the product obtained by grinding cacao

nibs free from shell or husk and germs, usually through triple stone mills, Bausman disc, or similar devices.

The above product comes in two types, i.e., natural process and Dutch process. The Dutch process type, or alkalized type, is prepared in the same manner as described for cocoas except that none of the fat is expressed. The natural chocolate liquor has a *p*H value of 5.1 to 6.0. The Dutched chocolate liquor has a *p*H value of 6.0 to 7.8, depending on the original *p*H of the nibs, and the amount and kind of alkali used. If more than 1½% alkali is used the liquor has a tendency to develop a saponified taste.

Chocolate liquors are molded into ten-pound cakes for commercial use, and in one-quarter to one-pound cakes for household use. Chocolate liquor is used for coating very sweet centers, such as hand roll centers and butter creams. It is also used as an ingredient for ice cream, candy, culinary products, and chocolate syrup. The Dutched type of chocolate liquor is used for flavoring tobacco, and for general uses where a milder and a darker product is desired. Chocolate liquor is often used in place of cocoa powder when a creamier and richer product is desired. The high fat content, 50 to 56%, however, makes its use difficult without such aids as homogenizers or emulsifiers.

Chocolate liquor is considered pure if it contains not less than 50% cocoa fat, and on the moisture and fat-free basis not more than 8% of total ash, not more than 0.4% of ash insoluble in hydrochloric acid, and not more than 7% crude fiber. The standards for Dutched liquor are the same as for natural process liquor, after due allowance being made for the kind and amount of alkaline substance added. The amount of alkaline substance permitted is not more than three pounds of potassium carbonate, or its neutralizing equivalent in other alkaline substances to each 100 pounds of cacao nibs.

Sweet chocolate, sweet chocolate coating, is chocolate mixed with sugar and/or dextrose with or without the addition of cacao butter, spices, or other flavoring materials. This definition applies to all sweet coatings regardless of the amount of sugar and chocolate liquor they contain. The phrase, other flavoring ingredients, is somewhat vague, and has led to some misunderstanding. The definitions for food products are so framed as to exclude anything not mentioned by name, but the strict interpretation of "flavor" would include any and all flavoring ingredients such as small amounts of malt, malted milk, skim milk, dairy butter, essential oil, etc.

Although dextrose (corn sugar) is permitted in chocolate, either alone or mixed with sucrose (cane sugar or beet sugar), it has been used only

to a very limited extent, and has not been studied sufficiently to denounce or extol its virtues.

Bittersweet coatings contain from 80 to 95% chocolate liquor and 5 to 20% sugar. Since the cacao butter content is very high, 40 to 50%, and the viscosity low, the addition of extra cocoa butter is not required. These coatings are prepared by adding sugar to chocolate liquor with or without flavor and refining. Bittersweet chocolates are dark in color and are used as couvertures for cordials, peppermint creams, fudge, whipped cream, Italian creams, hand rolls, butter creams, and marshmallow centers.

Mild bittersweet coatings contain from 50 to 75% chocolate liquor, from 25 to 38% sugar, and from 38 to 42% cacao butter. As the sugar content increases and the chocolate liquor content decreases, it becomes necessary to add additional cacao butter to obtain the proper viscosity. Mild bittersweet coatings are used for practically the same type of centers as bittersweet coatings, and are used to some extent for covering marshmallow crackers.

Dark sweet chocolates contain from 25 to 45% chocolate liquor, from 40 to 50% sugar, and vary in total cocoa butter content from 34 to 42%, depending on the desired viscosity of the finished coating. Dark sweet chocolates are used for enrobing such centers as nougats, cordials, peppermints, fudge, and nut-flavored cream fondants.

Medium dark sweet coatings are the most popular, being used to a great extent for molding chocolate bars and a variety of solid chocolate items for the retail trade, which are neither too sweet nor bitter for the average consumer's taste. They contain from 20 to 40% chocolate liquor, from 45 to 55% sugar, and from 32 to 42% total cocoa butter. The commercial product is sold in molded ten-pound cakes, and is used for enrobing such centers as caramels, nougats, fruit-flavored cream fondants, jelly centers, cocoanut cream fondants, vanilla cream fondants, nut clusters, raisin clusters, dates, figs, marshmallows, nutflavored cream fondants, cocoanut, sponge, chip and marshmallow cracker.

Light sweet coatings are of two types, the expensive type and the cheaper type. The expensive types are prepared from blends of light-colored and mild but chocolate-like cacao nibs such as Java, Ceylon, Maracaibo, etc., and a moderate amount of sugar, usually 45%. These coatings are very expensive, and are used for enrobing moderately sweet centers of the better sort. They are finely milled, conched, delicately flavored, and are representative of the chocolate expert's skill in the art of fine chocolate making.

The cheap type of light sweet chocolate coatings owe their light color to the small amount of chocolate liquor and the large amount of sugar

used in their manufacture. They usually contain from 5 to 15% chocolate liquor, from 55 to 68% of sugar, and contain a total cocoa butter content of 31 to 39%, depending on the fineness of grinding and their desired use. These coatings are used for special purposes, and for enrobing nut rolls, nuts, nut clusters, nut chews, raisin clusters, and for candy rolls containing peanuts, marshmallows, caramels, fudge, and other ingredients. The light sweet coating, though lacking in chocolate flavor and being excessively sweet, nevertheless, blends in nicely with the types of centers mentioned.

Milk chocolate, sweet milk chocolate, is the product obtained by grinding chocolate with sugar and/or dextrose, with the solids of whole milk, or the constituents of milk solids in proportion normal for whole milk, and with or without cacao butter, and/or flavoring material. It contains not less than 12% of milk solids. Milk chocolates usually contain 7 to 17% of chocolate liquor, 35 to 55% sugar, and a total fat content of 28 to 39%. There are many types of milk chocolate, varying in their degrees of milkiness, chocolate character, color, fineness, and viscosity. Milk chocolates are prepared from fresh whole milk which is first evaporated, and from milk powders, both spray and roller process types, and from skim milk powder to which has been added an amount of milk fat either in the form of dairy butter, or butter fat, necessary to convert the skim milk solids to whole milk solids.

In converting skim milk solids to whole milk solids by the addition of dairy butter, it is necessary to bear in mind that dairy butter contains 80 to 84% of milk fat, and approximately 16% water. The difficulties of removing the water and blending of the dairy butter with the skim milk solids, and the fact that 100 pounds of dairy butter yields approximately 80 pounds of milk fat, makes this method of milk chocolate preparation undesirable, and often more expensive than with the use of whole milk solids.

Milk chocolates owe their popularity to their delicate milk flavor, and lack of harsh or bitter taste. They are particularly liked by women and children. The manufacture of milk chocolate with an irresistible milky flavor is a difficult art, and is a secret closely guarded by chocolate manufacturers. Milk chocolates are sold over the counter of the ice-cream parlors and candy stores as broken milk chocolate, and in the form of bars which vary from a fraction of an ounce to a pound. Milk chocolate coatings are molded in ten-pound cakes and are used for enrobing such centers as nougats, vanilla cream fondants, nut rolls, nuts, nut clusters, and nut chews.

Ice-cream coatings are chocolate coatings of high cacao butter content containing from 50 to 60% fat. Their high fat content is necessary to

obtain a very thin running chocolate which will quickly drain off the solid ice-cream center when dipped. Ice-cream coatings may be of the dark sweet, medium dark sweet, light sweet, and milk chocolate types, due allowance being made for the high fat content. As their name implies, they are used exclusively for dipping ice-cream in the manufacture of ice-cream pops and eskimo pies. Since ice-cream coatings are frozen instantly on the ice-cream, and the same is kept at temperatures below freezing, the user of ice-cream coatings is not concerned with exact enrobing temperatures, nor with fat or sugar bloom. His chief problem is to combat the thickening up of the chocolate due to moisture absorption from the melting ice-cream. This difficulty is often remedied by the incorporation of three-tenths of one per cent lecithin in cacao butter.

Skim milk, buttermilk, milk chocolate coatings are sweet chocolate coatings containing not less than 12% of, respectively, skim milk solids, buttermilk solids, or malted milk and milk solids. These coatings are not defined in F.I.D. 191, or later additions to the Federal Pure Food Laws. Buttermilk coatings, and skim milk coatings, have become popular in the last few years. They are a cross between milk chocolate coatings and light sweet coatings. Skim milk and buttermilk cut down the excessive sweetness of a light sweet coating without sacrificing the light color. These coatings are used for enrobing the same types of centers as light sweet coatings, and in some cases milk chocolate coatings.

These coatings, in absence of a published definition for the same, should be labeled and sold for exactly what they are, namely, skim milk, buttermilk, or malted milk chocolate coatings.

Modified chocolate coatings are sweet chocolate coatings of various types, such as dark sweets, light sweets, and ice-cream coatings, to which has been added a small amount of skim milk, buttermilk, whole milk, or malt sugar. The amount added is usually 3 to 5%. These ingredients are added as flavoring ingredients, and to cut down the excessive sweetness of a light sweet coating, and also to cut the bitterness or sharpness of a dark sweet coating. The above ingredients are used to some extent in ice-cream coatings for the reasons mentioned, and for obtaining a softer eating chocolate of less brittleness than the ordinary chocolate coating, when same is frozen on the ice-cream.

Imitation chocolate coatings are mixtures of cocoa, sugar, and a substitute fat such as cocoanut oil, cocoanut stearines, illipe oil, etc., with or without flavoring ingredients. They are used mostly for enrobing cheap centers, and for medicated products where a higher melting point chocolate is desired than is obtained with cacao butter. Cocoanut oil coatings are used to some extent for ice-cream. Imitation coatings are

what their names imply, imitation chocolate coatings often lacking the true flavor and taste of pure chocolate.

Lecithin chocolate coatings are chocolate coatings of all types to which has been added a small amount of lecithin, usually not exceeding four-tenths of one per cent of lecithin in cocoa butter.

Lecithin modifies the physical properties of chocolate to some extent. Coatings can be made with three to eight pounds less of added cocoa butter per 100 pounds of chocolate, making them less fatty. Lecithin coatings resist thickening up due to moisture, allow greater flexibility in enrobing temperature, and cover centers more uniformly. Lecithin stabilizes chocolate coatings so that the viscosity is only slightly changed on aging, heating, or mechanical manipulation.

Cacao butter, cocoa butter, is the only fat common to chocolate, and is the edible fat obtained from sound cacao beans either before or after roasting. It is a yellowish-white solid having a faint, agreeable odor, and a bland chocolate-like taste, and is usually brittle at temperatures below 25° C. (77° F.). It is slightly soluble in alcohol, but is soluble in ether, chloroform, petroleum benzin, benzene, and in many other solvents. It has a specific gravity of approximately 0.8580 at 100° C. (212° F.), and 0.9100 at 40° C. (104° F.), when compared with an equal volume of water at 25° C. (77° F.). Cacao butter melts between 30° C. and 35° C. (86° F. and 95° F.), has a refractive index of approximately 1.4578 at 40° C. (104° F.), a saponification value of 188 to 195, an iodine value of 33 to 38, and a free fatty acid content of 0.70% to 1.4% calculated as oleic acid.

Cocoa butter is obtained by pressing chocolate liquor in the manufacture of cocoa powder, by passing cacao fines through the Expeller, and by solvent extractions from low fat cocoa press cake and cacao fines.

Cacao butter is used mostly for the manufacture of chocolate and confectionery, and to some extent for the manufacture of suppositories, creams, lotions, ointments, and soaps, and is also used for the treatment of burns, sunburn, and for massaging.

Chocolate, when properly molded, possesses a good gloss which, if not protected, soon becomes dull in appearance. Both heat and moisture rapidly destroy the luster of chocolate, and develop a mottled and gray surface commonly known as bloom.

Chocolate must be carefully melted, carefully tempered, and carefully cooled when manufactured, otherwise bloom may develop in a short time. The handling of chocolate is a fine art and requires very careful attention to details. If chocolate is cooled too rapidly, the outer surface will solidify, trapping the latent heat within, which heat will gradually find its way to the surface and cause fat bloom. The proper tempera-

USES OF COCOA

Uses.	Semi-Cocoas, Cocoa Nuggets, Cocoa Crumblers, Cocoa Chips, 32–45% Fat		High Quality Cocoas, 25–32% Fat		Breakfast Cocoas Not Less Than 22% Fat		Semi-Dry Cocoas, 15–18% Fat		Dry Cocoas, 10–12% Fat		Extra Dry Cocoas, 8–9% Fat	Very Dry Cocoas, 6½–7¾% Fat	Defatted or Solvent Extracted Cocoas, ½–3% Fat	By-Product Cocoa and Cocoa Cake, 5½–11% Fat	Prepared Cocoas Sweet Cocoas
	Natural	Dutched	Natural	Dutched	Natural	Dutched	Natural	Dutched	Natural	Dutched					
Baking					●	●	●	●	●	●					
Beverages			●	●	●	●	●	●	●	●					
Cake Fillers			●	●											
Cattle Feed														●	
Chocolate Biscuits						●		●		●					
Chocolate Crackers						●		●		●					
Choc. Flavored Desserts					●	●	●	●	●	●					
Chocolate Pies					●	●	●	●	●	●					
Cocoa, Malt, Sugar Mixt.							●	●	●	●					
Cocoa Milks							●	●	●	●	●	●			
Confectionery, Fudge			●	●	●	●	●	●	●	●					
Devil's Food Cake						●		●		●					
Dusting Powder												●	●	●	
Fertilizers														●	
Household Use					●	●			●	●					
Ice-Cream	●	●	●	●											
Icings	●	●	●	●											
Imitation Choc. Coatings									●		●	●			
Medicinal Powders or Tablets					●	●	●	●	●						
Sweet Cocoas					●	●	●	●	●	●					●
Syrups			●	●	●	●	●	●	●	●	●				
Theobromine													●	●	
Thin Syrups									●		●	●			
Tobacco			●	●	●	●	●	●	●	●					

USES FOR CHOCOLATE

	Chocolate Liquor	Bittersweet	Dark Sweet	Medium Dark Sweet	Light Sweet	Milk Chocolate	Ice Cream Coating	Skim Milk, Buttermilk	Imitation Coating	Cacao Butter
Butter Creams	●	●	●							
Candy Bars				●	●	●		●		
Caramels				●	●			●		
Chocolate Bars				●	●	●				
Chocolate Ice-Cream	●									
Chocolate Pops							●		●	
Chocolate Syrup	●									
Cocoanut Creams				●					●	
Cordials		●	●							
Culinary Products	●									
Frappé		●							●	
Fruit Flavored Creams				●					●	
Fudge	●	●	●		●			●		
Hand Rolls	●	●								
Ice-Cream Bars							●		●	
Italian Creams		●								
Jelly Centers				●					●	
Lotions										●
Marshmallows, Marshmallow Crackers		●	●	●	●			●		
Nougats			●	●	●	●		●	●	
Nuts, Nut Clusters, Nut Rolls				●	●	●		●		
Nut Flavored Creams			●	●					●	
Ointments										●
Peppermint Creams	●	●	●							
Raisins, Dates, Figs				●		●		●		
Sponge Centers				●					●	
Suppositories									●	●
Tobacco	●									
Vanilla-Creams				●		●		●	●	

ture for storing chocolate is 55 to 65° F., and the proper relative humidity 60 to 65%.

If chocolate is taken out from a cold room into a warm room, or placed in a damp room, a film of moisture will form on the surface. The fine sugar particles will dissolve and form a thin layer of syrup. On evaporation of the moisture, the sugar crystallizes in minute form, giving the chocolate a rough, grayish appearance, sometimes mottled by red-brown colored spots due to the coloring matter of the chocolate that may have dissolved in the moisture. This phenomena is known as sugar bloom.

If chocolate is stored in a warm place or exposed to heat, the cacao butter softens or melts, and expands, forcing its way through the spaces between the sugar and cocoa matter particles to the surface. On cooling the cacao butter crystallizes, forming a grayish-white film which is greasy to the touch. This type of bloom is known as fat bloom, and is a source of trouble during the summer months. Although the flavor is usually not impaired, the grayish appearance of the chocolate is considered by the public to be a sign of staleness, and results in great economic losses to the manufacturer. Chocolate picks up foreign odors

APPROXIMATE COMPOSITION OF CHOCOLATE COATINGS

	Chocolate Liquor	Sugar	Total Fat	Whole Milk Solids	Skim Milk or Buttermilk Solids
Bitter	100	0	50–56	0	0
Bitter-Sweet	80–95	5–20	40–50	0	0
Mild Bitter-Sweet	50–75	25–38	38–42	0	0
Dark-Sweet	25–45	40–50	34–42	0	0
Medium Dark-Sweet	20–40	45–55	32–42	0	0
High Grade Lt.-Sweet	15–25	40–50	34–39	0	0
Low Grade Lt.-Sweet	5–15	55–68	31–39	0	0
Sweet Milk	7–17	35–55	28–39	12+	0
Ice-Cream Bar	9–29	29–39	50–60	12+	0–6
Skim Milk, Buttermilk, Malted Milk	7–17	35–55	30–40	0	12+

Small quantities of flavoring materials such as vanillin, coumarin, coffee, cinnamon, peppermint, orange, lemon, anise, and synthetic cocoa-bean flavor also may be used.

readily, and should be stored in a clean room with free circulation of air.

Cocoa shells are a by-product of the cocoa and chocolate industries. They are used chiefly as a fertilizer ingredient, and also for the extraction of its fat and theobromine content.

COFFEE

The fruit of Coffea Arabica.

Coffee is indigenous to tropical Africa, more particularly to Abyssinia, from whence its growth undoubtedly spread across the continent to Liberia, where it grows wild and where it is also now extensively cultivated. The Liberian coffee plant is a distinct species, which seems to be less subject to disease and which has been successfully introduced into the East Indies.

The cultivation soon spread to the Western world, Cuba, Mexico, Central and South America, and at the present time Brazil produces about three-quarters of the whole world market.

In its wild state the coffee tree attains a height of from 20 to 30 feet and has somewhat the aspect of a cherry tree. In cultivation it is trimmed down to the height of about 6 feet. The coffee tree develops best in rich soil and in a tropical climate where the rainfall exceeds 75 inches per year.

The fruit is an oval, deep purple, two-seeded drupe, the parchment-like endocarp inclosing two plano-convex seeds, which are placed together by their flat sides and constitute the raw coffee of commerce. There are two general varieties:

BRAZIL COFFEES and MILD COFFEES

The Brazil coffees include the Santos and Rio coffees, the Mild coffees include the Java, Mocha, Bogota, Guatemala, Porto Rican, Mexican, Maracaibo, and a few others.

SANTOS COFFEE

Is shipped from the port of Santos. It is a mild and sweet coffee.

Santos coffee is usually blended with Bogota to obtain a good flavor and color.

RIO COFFEE

Is shipped from the port of Rio de Janeiro. It is a rather pungent coffee.

The roasting of coffee results in a notable reduction of some of the constituents, especially the caffein, fat, and sugar.

When properly conducted, the total loss in weight amounts to from 12 to 18%, of which about 8% represents moisture.

Coffee is sometimes glazed with sugar before roasting. According to Hilger and Juckenack, glazed coffee needs to be heated to a much higher temperature, which results in about double the loss of caffein and fat.

French roasted coffees belong to this class.

TEA

The tea plant is an evergreen shrub, which grows to a height of from 12 to 15 feet in the wild state, but under cultivation is kept about 4 feet high. Tea will grow in a variety of climates, but the sub-tropical appears to be the best, especially in sections where the rainfall is about 50 inches annually. According to the method of curing, three different kinds of tea are recognized:

I. Green or Unfermented Tea
II. Black or Fermented Tea
III. Oolong or Semi-Fermented Tea

All of these teas can be produced from leaves picked from the same bush.

GREEN TEAS

A. JAPAN GREEN TEAS

1. Basket-Fired Green Tea (long leaves)
2. Pan-Fired Green Tea (short leaves)

B. CHINA GREEN TEAS

1. Gunpowders (small round rolled leaves)
2. Imperials (large round rolled leaves)
3. Young Hysons (long rolled leaves)

There is no difference in the drinking qualities of these subdivisions, only in appearance. CHINA GREEN TEAS are generally known as SOUCHONG.

OOLONG TEAS

Oolong teas are produced on the Island of Formosa. They are fired when the leaves are only half fermented.

BLACK TEAS

A. Black Teas produced in China: Called English Breakfast Tea or Congou Tea.

B. Black Teas produced in India, Ceylon, Java, and Sumatra are classified according to the size of the leaf. The three young shoots at the tip are known as ORANGE PEKOE and PEKOE, which contain the least fiber, most juice, and produce the finest grade of tea. The leaves immediately below the Pekoe are named SOUCHONG, a tea of popular price. Pekoe and Souchong are sometimes mixed and sold as PEKOE SOUCHONG.

The difference between green and black tea is mainly due to the fact that the green tea is dried shortly after gathering, and then rolled and carefully fired, whereas black tea is first made up into heaps, which are exposed to the air for some time before firing and allowed to undergo fermentation, resulting in the conversion of its original olive green color into a black color.

CHAPTER VI

GELATIN DESSERT AND PUDDING POWDERS

Essentially, a gelatin dessert powder represents a mixture of gelatin and cane sugar alone or combined with dextrose, powdered gelatin, natural or imitation fruit flavor, fruit acid such as citric or tartaric, and certified food color.

Gelatin desserts are more popular today because of the constant striving of the manufacturer to improve the quality of the fruit flavor and to use a quality of gelatin as free as possible from bacteria, off odor and poor taste. The use of natural fruit flavor alone is incapable of producing that fruity individual taste and, therefore, the addition of an imitation fruit flavor is necessary. To make a free flowing gelatin dessert powder (one that will remain that way in the package) from 5 to 15% of corn sugar must be used, to retard serious lumping. In the manufacure of pudding powders the finest quality starch, low in moisture content and bacteria, should be employed. All products should be sifted after mixing and before final packaging.

GELATIN DESSERT POWDER

Formula No. 1 (For Bulk Sales)

Granulated Sugar	84 lb.
Gelatin Powder	12 lb.
Citric Acid Powder	2 lb.
Natural Fruit Flavor	1½ lb.
Imitation Fruit Flavor	To Suit
Certified Food Color	To Suit

Add five pints of boiling water to 17 oz. of above mixture, stir until dissolved.

GELATIN DESSERT POWDER

Formula No. 2 (For Package Sales)

Granulated Sugar	71 lb.
Gelatin Powder	12 lb.
Corn Sugar	13 lb.
Citric Acid Powder	2 lb.
Natural Fruit Flavor	3 lb.
Imitation Fruit Flavor	To Suit
Certified Food Color	To Suit

A 3¼ oz. package of the above mixture added to 1 pint of boiling water, will make a gelatin dessert. If fruits, nuts, etc., are to be used, add after gelatin dessert is cold and set sufficiently to hold them in place.

FLAVORS FOR GELATIN DESSERTS

Amount of Color and Flavor for a 100 lb. Batch

Strawberry	
True Fruit Flavor	6 oz.
Imitation Fruit Flavor	1/7 oz.
Amaranth Color Powder	4 oz.
Orange I Color Powder	1 oz.
Raspberry	
True Fruit Flavor	6 oz.
Imitation Fruit Flavor	1/3 oz.
Amaranth Color Powder	6 oz.
Cherry	
True Fruit Flavor	6 oz.
Imitation Fruit Flavor	1 oz.
Amaranth Color Powder	6 oz.
Pineapple	
True Fruit Flavor	6 oz.
Imitation Fruit Flavor	1 oz.
Tartrazine Color Powder	4 oz.
Lemon	
Lemon Oil	4 oz.
Tartrazine Color Powder	3 oz.
Orange	
Orange Oil	4 oz.
Orange I Color Powder	1 oz.
Lime	
Lime Oil	4 oz.
Tartrazine Color Powder	½ oz.
Light Green S.F. Powder	3 oz.

Dissolve the color in a minimum amount of hot water. Spray color and flavor on gelatin batches during mixing operation.

PUDDING POWDERS

CHOCOLATE FLAVOR

Formula No. 1 (Average Quality)

Granulated Sugar	60 lb.
Cocoa Powder	15 lb.
Cornstarch	25 lb.
Salt	1 lb.
Vanillin	3 oz.

CHOCOLATE FLAVOR
Formula No. 2 (Better Quality)

Granulated Sugar	53 lb.
Cornstarch	22 lb.
Tapioca Starch	6 lb.
Cocoa Powder	9 lb.
Ground Sweet Chocolate	9 lb.
Salt	1 lb.
Vanillin	2 oz.

CHOCOLATE FLAVOR
Formula No. 3

Granulated Sugar	60 lb.
Cornstarch	23 lb.
Cocoa Powder	20 lb.
Salt	1 lb.
Vanillin	3 oz.

The above puddings are weighed up into 4 oz. packages, cooked with one pint of water or milk, stirred constantly until they reach the proper thickening point.

VANILLIN FLAVOR
Formula No. 1

Granulated Sugar	64 lb.
Cornstarch	27 lb.
Skimmed Milk Powder	8 lb.
Salt	1 lb.
Vanillin	3 oz.
Certified Food Egg Color	If desired

Weigh above into 4 oz. packages, stir mixture into 1 pint of boiling water or milk.

VANILLIN FLAVOR
Formula No. 2

Granulated Sugar	70 lb.
Corn Sugar	15 lb.
Cornstarch	30 lb.
Salt	1 lb.
Vanillin	2 oz.

Use 4 oz. to 1 pint boiling milk.

VANILLIN FLAVOR
Formula No. 3

Granulated Sugar	55 lb.
Corn Sugar	15 lb.
Cornstarch	30 lb.
Salt	1 lb.
Vanillin	2 oz.

Use 4 oz. to 1 pint boiling milk.

COCOANUT FLAVOR PUDDING

Granulated Sugar	40 lb.
Cornstarch	38 lb.
Skimmed Milk Powder	10 lb.
Gelatin Powdered	2 lb.
Cocoanut Fine Cut	10 lb.
Vanillin	2 oz.

Use 4 oz. of the above mixture, in one pint of boiling water or milk. Thicken in double boiler.

MAPLE FLAVOR, POWDERED

Light Brown Sugar	65 lb.
Cornstarch	25 lb.
Salt	2 lb.
Powdered Caramel Color	1 oz.
Maple Flavor	1 oz.
Skimmed Milk Powder	6 lb.

Use 4½ oz. to 1 pint of boiling milk, cook over moderate heat, to gloss (185° F.-190° F.).

Caramel, cocoanut and butterscotch flavor can be manufactured by a similar method.

CUSTARD PUDDING

Formula No. 1

Granulated Sugar	71 lb.
Cornstarch	20 lb.
Gum Tragacanth	3 lb.
Tumeric Powder	1 lb.
Oil Bitter Almond	1½ oz.
Lemon Oil	⅛ oz.

Use 4 oz. of above to 1 pint of boiling milk, then pour into dishes, and bake as custard.

CUSTARD PUDDING

Formula No. 2

Granulated Sugar	71 lb.
Cornstarch	10 lb.
Arrowroot Starch	10 lb.
Tumeric Powder	1 lb.
Oil Bitter Almond	½ oz.
Oil Nutmeg	¼ oz.

Use in same manner as formula number 1.

CUSTARD PUDDING

Formula No. 3

Granulated Sugar	70	lb.
Cornstarch	20	lb.
Whole Egg Powder	6	lb.
Salt	½	lb.
Vanillin	2	oz.

Use as above recipe.

CUSTARD CREAM (French Style)

Granulated Sugar	60	lb.
Cornstarch	18	lb.
Whole Milk Powder	18	lb.
Powdered Egg Yolk	4	lb.
Shortening	4	lb.
Salt	½	lb.
Vanillin	2	oz.

Use 4 oz. of above to 1 pint of boiling water, then add to it 3 pints of cold water, and whip up until mixture thickens.

CUSTARD FILLING FOR PIES

Formula No. 1

Granulated Sugar	70	lb.
Whole Milk Powder	8	lb.
Cornstarch	16	lb.
Powdered Whole Egg	5	lb.
Salt	1	lb.
Vanillin	3	oz.

Stir 2½ lb. of above in 1 pint of water, pour this into 7 pints of boiling water, and stir until it thickens. Use when cold.

CUSTARD FILLING FOR PIES

Formula No. 2

Granulated Sugar	50	lb.
Skimmed Milk Powder	20	lb.
Powdered Whole Egg	10	lb.
Shortening	5	lb.
Tapioca Starch	15	lb.
Vanillin	1	oz.
Oil of Mace	¼	oz.

Whip 2 lb. of above into a smooth paste with 1½ pints of water, add then to 5 pints of boiling water, and heat until it thickens. Use when cool.

DRY VANILLA CREAM POWDERS

Formula No. 1

Granulated Sugar	30 oz.
Powdered Egg Yolk	1 oz.
Salt	¼ oz.
Corn Starch	11 oz.
Color and Vanilla Flavor	If desired

Add the above to 1 quart of milk, and mix until smooth. Then add gradually to 4 quarts hot milk, boil to 190° F., or until thick and glossy. A better product is obtained upon addition of 4 oz. of butter.

Formula No. 2

Granulated Sugar	41 oz.
Powdered Skimmed Milk	27 oz.
Powdered Whole Egg	4 oz.
Salt	1 oz.
Corn Starch	16 oz.
Color and Vanilla Flavor	If desired

Add the above to two quarts of water, mix into smooth paste. Then add gradually to 3 quarts boiling water, boil to 190° F. or until thick and glossy.

CHAPTER VII

SAUCES, CATSUP, MAYONNAISE, CONDIMENTS, PICKLES, MUSTARD

Sauces are blended extracts of condiments, vegetables, fruits, vinegar, etc., for use with meats, fish, soups and various other foods. They have been employed for culinary and table purposes since the time of the ancient Romans. Sauces of the Worchestershire kind, if of good quality, generally contain Soy as their chief character ingredient. A typical formula of Worchestershire style includes (in addition to Soy and vinegar) lime juice, onion, tamarinds, garlic, fish (such as anchovies or pickled herring) red chilies and spices. Sauces are really built-up foods and not simply a mixture of water, vinegar, some spice and a little sugar (added for sweetening).

To manufacture a good sauce, with definite distinctive flavor, it is necessary to give special attention to the selection and blending of the raw ingredients used.

The process of manufacture generally means the boiling together of the various ingredients, pulping or finishing, and then bottling. However, there is a great deal more than just this if a good product is desired. For example, there is the preliminary treatment of the spices or fruits to be considered, which often have to be boiled in vinegar in order to bring out the flavor. Very often it is necessary to thicken the sauce to give it more body; gums, starches, flour, pectin, or purified Irish moss may very safely be used for this purpose. Thickeners should always be added at the end of the manufacturing process, the only exception being when a sauce is made entirely without heat or cooking. If the thickener is not added at the right time to cooked sauces, the acid tends to break down the thickener to simpler elements, due to hydrolysis.

Even with thorough boiling, solid pieces, such as herbs, spices, skins, pits, etc., sometimes remain in the sauce. Unless these are properly removed, they detract substantially from the quality of the product. The best way to accomplish this is to pass the sauce through a pulping machine or force it through a fine sieve. The sauce can also be greatly improved by running it through a colloid mill or homogenizer, just before transferring it into the filling machine. This tends to give it a closer texture, and the sauce is less apt to settle out on standing.

One of the problems the sauce manufacturer has to cope with is that of fermentation in the bottle. Fermented merchandise is generally returned to the manufacturer, thus involving a financial loss and other inconveniences. This condition can be corrected by heating the sauce and filling the bottles while it is still hot. The sauce is much easier to pour while hot and, at the same time, the chances of outside contamination are greatly reduced.

In order to obtain a mellow flavor, the sauce should be pumped into huge aging or mellowing vats, and then allowed to mature in bulk, rather than in bottles. Frequent stirring with wooden paddles during the maturing process is necessary in order to prevent caking or settling of solid particles. The best sauces are these which have been allowed to age. (Of course, it is assumed that perfect ingredients were used to begin with.) The use of glacial acetic acid, which is sometimes added to sauces, is prohibited by law.

Tough substances should be soaked in vinegar, water or sugar syrup before using them, to facilitate the diffusion of flavor later on in the main mixing vats. Where it is necessary to chop up or pulp the fruit, hard fruits may be steamed and allowed to soak overnight in hot water; then they can then very easily be put through a food chopper or pulper.

In some instances, separation seems unavoidable in the finished product but this can be corrected by addition of a thickener, stabilizer, or by putting the sauce through a homogenizer.

It would be well to consider the importance of using sterilized spices in the manufacture of sauces. As shown in the table below, fruits and vegetables, cereal flours, and similar sauce materials are prolific carriers of bacteria, molds and yeasts. These spice ingredients, even though used in small quantities, may be the cause of popping and fermentation in the finished product. During recent years much progress has been made in the treatment of raw ingredients with the aim of reducing the microorganism content of food likely to cause spoilage in the finished package. While spice and flavoring herbs have generally been considered to be free of contamination and to possess antiseptic properties, this has long ago been proven false.

TOTAL BACTERIA COUNTS ON SAMPLES OF UNTREATED SPICES

Spice	Bacteria per gram	Mold and Yeasts per gram
Allspice, (ground)	214,000	2,300
Cinnamon, (ground)	110,000	22,200
Coriander, (ground)	400,000	....
Coriander, (whole seed)	190,000	4,640
Garlic, (ground)	5,775	....
Ginger, (ground African)	2,100,000	....
Nutmeg, (ground	10,000	110
Paprika, (ground)	1,500,000	140
Pepper, (whole black)	2,770,000	90
Pepper, (whole Carolina red)	20,000	560
Pepper, (whole Cayenne red)	2,047,000	100
Pepper, (whole Japanese finger)	4,000	40
Pepper, (ground fine, red)	16,000,000	2,500
Pepper, (ground white)	158,000	2,220
Tumeric, (ground)	1,835,000	100

TOTAL BACTERIA COUNT ON SAMPLE OF UNTREATED FOOD INGREDIENTS

Food	Bacteria per gram	Mold and Yeasts per gram
Acacia (gum) powder	3,330	494
Apricots (dried)	195	75
Broccoli	32,800	120
Cocoa	627	10
Corn flour	18,000	110
Corn flour (processed)	5,000	10
Karaya (gum) powder	19,350	1,387
Prunes (dried)	49	28
Raisins (dried)	82	60
Soy flour	3,800	....
Spinach	1,020,000	1,570
Strawberries (whole)	172,800	2,600
Tragacanth (gum) powder	14,540	70
Tragacanth (gum) ribbon	640	160
Wheat flour	13,000	....

TOTAL REDUCTION BACTERIA COUNT IN SPICES BY HEAT TREATMENT

Test No.	Spice	Untreated count per gram	Treated count per gram	Kill per cent
1	African ginger	2,100,000	80,000	96.19
2	Fine red pepper	16,000,000	2,400,000	85.00
3	White pepper	80,000	12,200	84.75
4	Coriander	400,000	30,000	92.50
5	Nutmeg	10,000	Sterile	100.00
6	Cinnamon	110,000	7,000	93.64
7	Allspice	214,000	21,500	89.95
8	Paprika	1,500,000	300,000	80.00

BARBECUE SAUCE
Formula No. 1

Powdered Garlic	1/5 oz.
Powdered Onion	1/5 oz.
Butter	4 lb.
Vinegar (100 grain)	2 pt.
Salt	3 oz.
Paprika	2 oz.
Black Pepper	3/4 oz.
Red Pepper	3/4 oz.
Chili Powder	2 oz.
Cane Sugar	6 oz.
Tomato Puree	6 oz.
Mustard Prepared	8 oz.
Worcestershire Sauce	2 oz.
Tabasco Sauce	1 oz.
Locust Bean Kernel Gum	8 oz.
Water	36 lb.

To the hot water, with the aid of a high speed agitator, add the locust bean kernel gum. When dispersed add the balance of ingredients, heat to boiling point, fill while hot with straining and then pasteurize.

BARBECUE SAUCE
Formula No. 2

Worcestershire Sauce	8 oz.
Tomato Juice	3 lb.
Corn Oil	8 oz.
Pepper	1½ oz.
Salt	2 oz.

Dry Mustard	1½ oz.
Paprika	1½ oz.
Cayenne	¼ oz.
Vinegar Distilled	3 pt.
Garlic Minced	¼ oz.
Onion Grated	1 lb.

Mix all of the above ingredients together.

BROWN SAUCE

Beef Fat	1 lb.
Minced Onion	½ lb.
Parsley	1 oz.
Flour	1½ lb.
Beef Stock	8 lb.

Melt fat over low heat, add vegetables, fry gently for ten minutes. Now add flour, cook over medium heat, stirring until flour turns a deep brown. Add the beef stock, stirring until smooth and thickened. Salt, Worcestershire, etc. can be added for taste. Strain the sauce and fill (hot) into bottles and then pasteurize.

BUTTERSCOTCH SAUCE

Brown Sugar	8 lb.
Corn Syrup	3 lb.
Boiling Water	2 pt.
Butter	1 lb.
Vanilla Extract	1½ oz.
Salt	½ oz.

Heat sugar, corn syrup and water to 230° F. Shut off heat, add butter and when cool add salt and vanilla flavor.

For butterscotch cream sauce use above recipe, use cream instead of water, cook sugars and cream together until sugar is melted and mixture is just cooking. Stir constantly, add flour when cold.

CARAMEL SAUCE

Corn Syrup	4 lb.
Brown Sugar	3 lb.
Butter	½ lb.
Sweet Cream (18% Fat)	2 lb.

Add the brown sugar to the warm corn syrup and heat until completely dissolved, add the butter and stir until melted. Now add the cream, stir and heat to about 230° F.

CHOCOLATE SAUCE

Bitter Chocolate	6 lb.
Powdered Skimmed Milk	3 lb.
Water	2 gal.
Flour	3 lb.
Granulated Sugar	25 lb.
Butter	3 lb.
Vanilla Extract	3 oz.
Salt	2 oz.

Dissolve the sugar in the hot water, add flour as a thin paste, heat until the flour just gels. Add the chocolate, butter and mix. Now add the milk powder, which is made into a thin smooth paste with water. Cook while stirring constantly until smooth and thick. Flavor with vanilla. This sauce can be used cold or warm.

FRENCH DRESSING

Salad Oil	4 oz.
Cider Vinegar	2 oz.
Salt	6 gr.
Pepper	1 gr.
Paprika	1 gr.

Combine the above ingredients.

List of spice seasonings, which can be used in manufacturing French Dressing.

Garlic	Dry Mustard	Chopped Chutney
Celery Seed	Tarragon Vinegar	Worcestershire Sauce
Horse Radish	Chili Sauce	Tabasco Sauce
Onion Juice	Tomato Catsup	Cayenne
	Curry Powder	

FISH FRUIT SAUCE (THICK)

Water	3 pt.
Distilled Vinegar 100 grain	6 pt.
Invert Sugar Syrup	1¼ lb.
Ginger Syrup	½ pt.
Ground Dates	2½ lb.
Sweet Orange Marmalade	2 lb.
White Chopped Raisins	2 lb.
Apple Pulp Unsweetened	2 pt.
Tomato Puree	5 pt.
Garlic Powder	½ oz.
Shallots	5 oz.
Tamarinds	2 lb.
Anchovy Essence	½ pt.
Caramel Color	½ pt.
Salt	¼ lb.
Tragacanth	1 oz.

The above is boiled. The tragacanth is added last. Then add the following:—

Mace	½ oz.
Cayenne Pepper	¼ oz.
Mixed Spice	½ oz.
Cloves	¼ oz.
Cinnamon	⅛ oz.
Lactic Acid 50% strength	¼ lb.
Gelatinised Flour	¼ lb.

Simmer entire recipe for ½ hour. Make paste of cornstarch, etc.

Soak tamarind (just to loosen fiber), crush apples, use whole or powdered spice, etc.

FUDGE SAUCE

Bitter Chocolate	1½	lb.
Butter	8	oz.
Boiling Water	4	pt.
Corn Syrup	1½	lb.
Cane Sugar	8	lb.
Salt	½	oz.
Vanilla Extract	1	oz.

Add butter to the melted chocolate and, when dispersed, add the boiling water with stirring. Continue cooking, add corn syrup, and cane sugar. Boil for about 5 minutes. Cool, then add salt and vanilla flavor.

ITALIAN TOMATO SAUCE

Olive Oil	1	lb.
Garlic (Minced)	1	oz.
Green Pepper (Minced)	8	oz.
Celery (Chopped)	1	lb.
Onion (Chopped)	2	lb.
Parsley	2	oz.
Carrots (Chopped)	1	lb.
Tomatoes (Canned)	20	lb.
Bay Leaves	2	oz.
Thyme	1	oz.
Salt	6	oz.
Cayenne Pepper	½	oz.
Whole Cloves	5	oz.
Cane Sugar	12	oz.
Italian Tomato Paste	4	lb.

Heat oil, add vegetables, fry gently and do not allow vegetables to brown. Add canned tomatoes, spices, and simmer for 45 minutes. Strain, add tomato paste, and if a hotter sauce is required, add tabasco sauce. For a thicker sauce, add flour, cook until it thickens. Fill hot into bottles and pasteurize.

MEAT SAUCE

Onions	10	oz.
Carrot	20	oz.
Garlic	¾	oz.
Fat	2½	lb.
Flour	1½	lb.
Beef Stock	20	lb.
Bay Leaf	3	oz.
Whole Cloves	2	oz.
Thyme	1	oz.
Pepper	2	oz.

Melt fat over low heat, then add vegetables which have been put through a meat grinder. Fry gently for ten minutes with stirring. Now add flour, cook with stirring until flour turns dark. Add spices and continue cooking until thick. Season to taste. Strain, fill hot into bottles and pasteurize.

MAPLE SAUCE

Maple Syrup	16	lb.
Sweet Cream (18% Fat)	6	lb.
Chopped Nuts (Walnuts, Pecans, or Almonds)	4	lb.

Cook syrup and cream to 230° F., mixing thoroughly while being brought to the proper temperature. The chopped nuts may be omitted if so desired.

MOCHA SAUCE

Bitter Chocolate (Small piece)	6½	lb.
Strong Hot Coffee (Prepared with 4 lb. of coffee and water)	2	gal.
Granulated Sugar	40	lb.
Corn Syrup	10	lb.
Butter	3	lb.
Vanilla Extract	8	oz.
Salt	4	oz.

Dissolve the sugar in the hot corn syrup. Add the butter with stirring, then the chocolate. Mix until completely dissolved. Add the hot coffee, salt, and cook to 230° F. Upon cooling, flavor with vanilla.

MUSHROOM ANCHOVY SAUCE

Anchovies (Chopped)	12	lb.
Mushroom Catsup	1	gal.
Madiera Wine	3	qt.
Cayenne Pepper	½	lb.

Boil catsup, chopped anchovy and pepper for 30 minutes and pass through sieve. Add wine when quite cold and stir well.

PUNGENT SAUCE

Malt Vinegar	1½ pt.
Curry	2 oz.
Tamarinds	1 lb.
Water	½ pt.

Soak tamarinds for 12 hours, pass through sieve, then add vinegar; add curry powder while stirring. Boil rapidly for five minutes. Fill into bottles while hot.

MUSTARD SAUCE

Mustard Flour	20 lb.
Tapioca Starch	2 lb.
Powdered Garlic	2 oz.
Powdered Onion	2 oz.
Cane Sugar	20 lb.
Salt	6 lb.
Ground Mace	4 oz.
Distilled Vinegar (100 grain)	6 gal.
Powdered Tumeric	Enough to color
Water	16 gal.

Soften the mustard and mace overnight in about 5 gallons of water. To the balance of water in a steam jacketed kettle add the sugar, bring to a boil, then add the starch (which has been suspended in a little water). Stir the mixture vigorously, with steam going until the starch becomes translucent. Shut off steam. Add the balance of ingredients, stirring in well and boil gently for about 15 minutes. Pass the entire batch through a fine sieve and fill at a temperature higher than 180° F.

RUSSIAN SALAD DRESSING

Mayonnaise	25 lb.
or	
Salad Dressing	25 lb.
Chili Sauce (Drained)	2 gal.
Tabasco Sauce	⅙ oz.
Green Pepper Minced	1 lb.

Mix all the above ingredients.

SAUERKRAUT-TOMATO JUICE COCKTAIL

Sauerkraut Juice	1 pt.
Tomato Juice	3 pt.
Onion Salt	⅛ oz.
Worcestershire Sauce	1½ oz.
Salt	¾ oz.
Pepper	¾ oz.

Mix above ingredients, fill into bottles and pasteurize.

SEA FOOD SAUCE

Catsup	4 lb.
Lemon Juice	6 oz.
Tabasco Sauce	½ teaspoonful
Celery Salt	3 oz.
Salt	1½ oz.
Pepper	½ oz.
Worcestershire Sauce	6 oz.
Dry Mustard	1 oz.
Parsley (Minced)	1½ oz.
Onion (Minced)	1½ oz.

Mix the above ingredients thoroughly and keep in cold place.

TOMATO JUICE COCKTAIL

Tomato Juice	10 pt.
Celery Salt	1 oz.
Lemon Juice	7 oz.
Worcestershire Sauce	2 oz.
Tabasco Sauce	1 c.c.
Sugar	2 oz.
Onion Juice	2 oz.

Mix the above ingredients, fill into bottles and pasteurize.

THOUSAND ISLAND DRESSING

Mayonnaise	25 lb.
Chili Sauce (Drained)	2 gal.
Chopped Olives	3 lb.
Green Peppers (Minced)	1½ lb.
Onion (Minced)	⅓ lb.
Pimento (Minced)	⅓ lb.

Mix all of the above ingredients.

TOMATO SAUCE (GOOD QUALITY)

Tomato Puree	10 gal.
Vinegar	1½ gal.
Sugar	15 lb.
Salt	3 lb.
Onions Powdered	½ lb.
Paprika (Ground)	¼ lb.
Allspice	1¼ oz.
Cloves (Ground)	¼ oz.
Mace (Ground)	¼ oz.
Cayenne Pepper	⅛ oz.
Garlic (Powdered)	1/10 oz.

Cook to a final volume of 12 gallons. Add most of sugar, salt, paprika, onions, and garlic to batch when about half finished. Pass through finisher or smoothening machine.

WORCESTERSHIRE SAUCE

	Good Quality	Medium Quality
Vinegar (100 grain)	12 gal.	14 gal.
Malt Vinegar	5 gal.	
Water		
Mushroom Catsup	10 gal.	
Walnut Flavor	8 oz.	1¼ gal.
Soy Sauce	6 gal.	3½ gal.
Sherry Wine or Flavor	5 gal.	
Black Strap Molasses	2½ gal.	3 gal.
Salt	11 lb.	7½ lb.
Brown Sugar	20 lb.	15 lb.
Tamarinds	10 lb.	
Onion Powder	2 lb.	
Garlic Powder	¼ lb.	8 oz.
Anchovies (Ground)	21 lb.	
Tragacanth	½ lb.	
Cayenne Pepper	1 lb.	3½ lb.
Black Pepper	1 lb.	
Lovage Root	⅛ oz.	
Allspice	1 lb.	
Cloves	⅛ oz.	3 oz.
Cinnamon	⅛ oz.	
Mace	7 oz.	
Nutmeg	3 lb.	
Ginger	1 lb.	
Lemon Peel	2 lb.	

Prepare the spices in advance by allowing them to soak in vinegar. All of the ingredients should be agitated for at least several hours. Run through strainer, to catch large pieces, before filling into bottles or barrels.

HOT CURRY

Coriander	1½ lb.
Cumin	½ lb.
Turmeric	1 lb.
Ginger	2 oz.
Mustard	1 oz.
Foenugreek	1 oz.
Cayenne Pepper	1½ oz.

TABLE SAUCE

Allspice	2 oz.
Black Pepper	1 oz.
Cloves	1 oz.
Mustard	8 oz.
Brown Sugar	3 lb.
Salt	1 lb.
Vinegar	4 gal.

Mix and place on the fire and simmer for about 2 hours. Then strain through a cloth and add enough sugar color to give it the desired dark shade. Let stand for 2 weeks before using. Keep in a keg; it will improve with age.

CHILI SAUCE

Ripe Tomatoes, Chopped Fine	5 lb.
Vinegar	2 pt.
Garlic	1 oz.
Red Pepper	1 dr.
Salt	2 oz.
Lemon Juice	5 oz.

Boil for an hour, then force through a colander and bottle while warm. Cork tight.

TABLE MUSTARD

Mustard Flour	1 lb.
Vinegar	1 qt.
Jamaica Pepper	1 dr.

Boil the vinegar and pour over the mustard. Stir until all lumps are gone, add the pepper and let stand several days, well covered. Add salt to suit. Force through a colander, if necessary.

FRENCH MUSTARD

The same as table mustard with the addition of 8 ounces of sugar and a trace of powdered cloves.

SAUSAGE SEASONING

Sage	½ lb.
Pepper	1 lb.
Allspice	1 lb.
Salt	1 lb.

Or

Cayenne Pepper or Capsicum	1 oz.
Cumin	1 oz.
Cassia	1 oz.
Nutmeg	2 oz.
Pimento (Allspice)	6 oz.
Black Pepper	8 oz.
Salt	8 oz.

SOUP SPICE

Lemon Peel	½ lb.
Thyme	1 lb.
Sweet Marjoram	½ lb.
Summer Savory	½ lb.
Parsley, Dried	1 lb.
Celery Seed	¼ lb.
Sweet Brazil	¼ lb.

CURRY POWDERS

Coriander	300 lb.
White Pepper	30 lb.
Red Pepper*	30 lb.
Yellow Mustard	30 lb.
African Ginger	15 lb.
Mace	7½ lb.
Cumin Seed	60 lb.
Fennel Seed	7½ lb.
Cardamom	30 lb.
Turmeric	75 lb.
Foenugreek	30 lb.
Saigon Cassia	25 lb.
Mint	18 lb.
Celery Seed	7½ lb.
Cloves	7½ lb.

Or

Coriander	3 lb.
Black Pepper	1 lb.
Cayenne Pepper	¼ lb.
Mustard (Yellow)	1 lb.
Jamaica Ginger	1 lb.
Cumin Seed	¼ lb.
Cardamom	½ lb.
Turmeric	3 lb.
Cloves	¼ lb.
Allspices	½ lb.

* If a milder curry is desired, leave out the red pepper.

FRENCH DRESSING

Into

Water	1 gal.
Cider Vinegar	8 gal.
Worcestershire Sauce	2 qt.

Mix by stirring or agitation

Mustard Flour	2 lb.
Paprika	5 lb.
Salt	13 lb. 13 oz.
Black Pepper	9⅗ oz.
Sugar	20 lb.

until the salt and sugar are dissolved, which may require 5-10 minutes. Then add

Olive Oil	8 gal.
Cottonseed Oil	2 gal. 2¾ qt.

and agitate vigorously until there is an emulsion formed before filling bottles.

MINT SAUCE

Granulated Sugar	120 lb.
Vinegar	16 gal.
Water	16 gal.
Spearmint Oil	4 fl. oz.

Sugar and water must be mixed and agitated previous to the addition of the vinegar and spearmint. Final batch must stand overnight before bottling.

MAYONNAISE

Aside from its popularity as a bread spread appetizer and salad dressing, mayonnaise is greatly appreciated also for its food value. In food manufacturing it is very conveniently used as a base for making vegetable salads, other salad dressings, etc.

The manufacture of a high grade mayonnaise requires the use of good quality eggs, oil, vinegar, spices and the use of superior equipment. A good mayonnaise is a semi-solid emulsion of edible vegetable oils, egg yolk or whole egg, vinegar and/or lemon juice, salt, seasoning, sugar and/or dextrose.

MAYONNAISE

Formula No. 1

Egg Yolk (Fresh or Frozen)	15 lb.
Sugar	3 lb.
Mustard Flour	1¼ lb.
Salt	1 lb.
Paprika	¾ oz.
Pepper (White)	1 oz.
Oil (Salad)	12 gal.
Vinegar (100 grain, white)	4 qt.
Water	2 qt.

Beat the yolks at high speed until they are thoroughly broken, which may require about one minute.

Now add the sugar, salt and spices and beat for another 2 to 5 minutes until the mixture is well creamed.

Now start adding the oil slowly, at the rate of a gallon per minute, un-

til 8 gallons have been added. Change the speed of the beater to first speed while adding one quart of vinegar and one quart of water; the mixture should be thoroughly agitated. Turn the beater on high speed and add the remainder of the oil the rate of one gallon every two minutes. Then shift the beater to slow speed and add the remainder of the vinegar and water.

The beater should now be shut off to scrape down the sides of the bowl. Then mix the entire batch at slow speed for at least another two minutes taking care not to overbeat which tends to make the mayonnaise thin.

MAYONNAISE

Formula No. 2

Egg Yolk	5 lb.
Oil	2¼ gal.
Vinegar (45 grain)	1¼ qt.
Sugar	10 oz.
Mustard Flour	4 oz.
Salt	6 oz.
White Pepper	½ oz.
Paprika	½ oz.

This formula yields 25 lbs. of mayonnaise showing 70% oil and 20% egg yolk.

MAYONNAISE

Formula No. 3

High quality. Sharp in taste. Very popular for grocer's trade.

Frozen Egg Yolk	120 lb.
Winter Oil (Cottonseed Oil)	330 lb.
Spice Mixture	24 lb.
Vinegar **	160 lb.
Salt	200 lb.
Mustard (Ground) No. 1	100 lb.

** Vinegar: Use cider vinegar. Dilute 9 gallons of vinegar with 1 gallon of water.

Mix the frozen egg yolk (which must be taken out of the refrigerator the night before making the batch) with a part of the vinegar and the spices. Be sure to keep some vinegar to be added last or if the batch breaks. Allow the oil to flow in slowly.

MAYONNAISE

Formula No. 4

Thicker than Formula No. 3, milder in taste, good keeping qualities. Cheaper.

Frozen Egg Yolk	7½ lb.
Winter Oil (Cottonseed Oil)	33 lb.
Spice Mixture (As in Formula No. 1)	2 lb.
Vinegar (As in Formula No. 1)	10 lb.

MAYONNAISE

Formula No. 5

Cottonseed Salad Oil	70.25 lb.
Egg Yolk	10.00 lb.
Vinegar (50 grain)	10.00 lb.
Water	3.90 lb.
Salt	1.45 lb.
Sugar	3.50 lb.
Mustard	.80 lb.
White Pepper	.10 lb.

The egg yolk can be reduced to 7.5 pounds. The sugar can be left out.

MAYONNAISE

Formula No. 6

Cheap. Good keeping qualities. Very popular for restaurants.

Frozen Egg Yolk	4½	lb.
Winter Pressed Cottonseed Oil	75	lb.
Salt	13	oz.
Mustard No. II	8	oz.
White Vinegar	1	qt.
Water	2	qt.

MODIFIED MAYONNAISE

Egg Yolk	2	lb.
Oil	21	lb.
Pectin Powder (#100 grade)	1½	oz.
Sugar	4¾	oz.
Salt	4¾	oz.
Mustard Flour	2½	oz.
Lemon Juice	3	oz.
Water	14	oz.
Vinegar 100 grain	20	oz.

SALAD DRESSING

Formula No. 1

Corn Starch	5	oz.
Water	90	oz.
Cottonseed Oil	51	oz.
French Mustard	25	oz.
Salt	5	oz.
Sugar	10	oz.
Vinegar (White)	42	oz.

Mix the cornstarch with a little cold water and add to the remaining hot water. Stir and boil until it stiffens, set aside to cool. Put the mustard into a bowl and gradually add the oil, stirring all the time. Next add sugar, salt, vinegar, and then the cooled cornstarch.

SALAD DRESSING

Formula No. 2

Tapioca Starch	7	oz.
Water	30	oz.
Corn or Cottonseed Oil	40	oz.
Salt	2	oz.
Cane Sugar	4	oz.
Vinegar (White 5%)	17	oz.

SALAD DRESSING

Formula No. 3

Corn Starch	5¼	oz.
Water	80	oz.
Oil	80	oz.
Mustard Flour	25	oz.
Paprika	Dash	
Cayenne	Dash	
Vinegar (100 grain white)	20	oz.
Egg Yolk	14	oz.

To make starch paste, add to the steam jacketed kettle all the required water minus a small portion with which to make a cold starch paste. Bring this water to a boil and add the cold starch paste with stirring, and cooking until transparent.

Allow this starch paste to cool to room temperature before manufacturing it into a salad dressing.

MANUFACTURE OF SALAD DRESSING

Add the spices and the egg yolk, beat at high speed and add half of the vinegar slowly. Red oil is then added in small quantities, beating constantly. As the mixture thickens gradually, add the rest of the vinegar and oil and continue beating until a creamy texture is obtained. Now add the cooled corn starch paste and beat at high speed until creamy.

MANUFACTURE OF PREPARED MUSTARD

Prepared mustard is a paste composed of a mixture of ground mustard seed, mustard flour or mustard cake, with salt and vinegar, with or without sugar or dextrose or other condiments. The above definition naturally permits the utilization of a wide range of spices and vinegar. The amount of spices, vinegar and salt determines the quality and taste of the finished product.

In practically all types of prepared mustard, a blend of different varieties of mustard seed is used, the exact proportion of each variety de-

pending partly upon the color and flavor desired in the finished product, and partly upon current market conditions.

Practically all formulas call for either or both white (or yellow) mustard seed and black (or brown) mustard seed. All varieties of mustard seed contain a bland fixed oil. The seed of the white mustard, Sinapis alba, contains little or none of the hot, volatile mustard oil (allyl isothiocyanate). This seed is the main ingredient in the mild, yellow, or French style mustard. Black mustard seed (from Brassica nigra, or related varieties) contains appreciable quantities of the volatile mustard oil (not less than 0.6 percent). Brassica juncea, also extensively used, is an Oriental species with a yellow seed, containing appreciable quantities of volatile oil.

Distilled (white or spirit) vinegar is used, cut to a sertngth of 35 to 40 grain. Enough vinegar must be used to give the proper consistency and flavor, and to assist in the preservation of the product. Too much vinegar should not be used because a pronounced acid flavor is not desirable. The spices used depend to a great extent upon the market to be supplied. Some sections of the country prefer a mild smooth flavor, while others demand a hot, highly spiced product. Among the spices used are cinnamon, cloves, nutmeg, ginger, allspice, black, red, cayenne, and tabasco peppers, bay leaves, celery seed, turmeric, curry powder, thyme and powdered garlic.

The mustard seeds are crushed, the vinegar diluted to the proper strength, the spices finely ground, the salt freed from lumps, and the ingredients for a given formula are weighed or measured, and blended in a large vat before milling. A wet grinding process is used, the blended ingredients being run through buhr stones and finished in a second set of stones. The stones must be carefully and frequently dressed by an experienced person and must be loosened and readjusted to the proper pressure after every stopping of the mill. A good "finish" depends upon the cut of the stones, the pressure or "set" of the stones, the speed of rotation, and the rate of flow of the mix.

For immeditae use, to be made up in smaller quantities, a prepared mustard may be made by stirring boiling vinegar into mustard flour. Salt and spices or spice oils should be added to the vinegar before blending with the mustard flour.

Cheap imitation mustards are on the market, in which more or less mustard bran (ground mustard hulls) is used as a filler. Equipment required in a mustard plant includes mixing tanks, pumps, grinding and finishing mills.

TOMATO CATSUP

Catsup is a descriptive term for a number of different products which consist of the pulp, strained and seasoned, of various fruits, the variety made from tomatoes being the most popular condiment in this country. A good catsup is judged by flavor, consistency, uniformity and attractiveness of color.

MANUFACTURE OF TOMATO CATSUP

In the manufacture of tomato catsup, the tomatoes are first scalded with steam, and then converted into pulp. They are passed through pulping machine or finisher, in which they are forced through a fine mesh cylindrical screen. This removes skins, seeds, and other undesirable parts of the tomato. The pulp is then pumped to the catsup boiling tanks, where it is mixed with salt, vinegar, sugar, and various spices. A common proportion is 70 pounds of salt to 500 pounds of sugar, and sufficient vinegar to yield 1.6% acetic acid in the final product.

When a batch of catsup reaches the proper consistency in the boiling tank, it is emptied through a finisher, similar to those described for tomato juice. This serves to smooth out the catsup and to eliminate any tendency to be curdy. From a receiving trough under the conditioner, the catsup is pumped to supply tanks over to the bowls of the bottle-filling machines. If the catsup is filled hot into the bottles at a temperature around 205° F., it is not necessary to pasteurize it for 45 minutes at 185° F.

MANUFACTURE OF CONCENTRATED TOMATO PULP AND CATSUP

The open kettles used for concentrating tomato pulp may be of wood, copper, block tin, Monel, or glass lined. The open kettles are often not steam-jacketed, but are heated by closed copper coils (known as flash coils), 3 inches in diameter. Under normal conditions it takes 35–50 minutes to concentrate 50 gallons of pulp to one-half the volume with the use of flash coils.

Where wood tanks are required, they are made of cypress wood. Unless these tanks are always kept very clean and free from mold growths, a musty or moldy flavor may be imparted to the tomato pulp. Copper kettles are more expensive and have only one disadvantage, that the copper may spoil the color of the pulp.

COOKING THE PULP

While concentrating the pulp, there may be considerable foaming, which can be prevented by adding a small amount of cottonseed oil. The kettle is filled with the tomato pulp, just enough to cover the coils or steam-jacketed part of the kettle. Steam is now admitted and the boiling is started. The concentration must be accomplished rapidly to retain the bright color. Boiling for 30 minutes is usually sufficient in a tank having a good flash coil and enough high pressure steam. The finishing point of the tomato pulp, or puree, is determined by specific gravity which should be 1.050.

SPICES AND CONDIMENTS USED

The cloves should be the headless type, Penang cloves being the most popular. The cinnamon used is the broken stick form, preferably Sargon cinnamon. The mace is received from the Penang or Banda districts, while cayenne and oinions should be selected for pungency. Hot onions are preferable to mild ones, the same being also true of the cayenne. Paprika is sometimes also used to intensify the red color of the catsup, but adds very little flavor.

EXTRACTION OF SPICES

Spices are usually added to tomato catsup as a vinegar extract, prepared by adding the spices to distilled vinegar and steeping at about 185° F. in covered wooden or glass-lined tank for 2–3 hours. The special vinegar is now separated from the spices and added to the pulp in the catsup kettle. Sometimes onions, garlic, and spices are tied in a bag and suspended in boiling catsup for extraction. In this case the spices are used a second time by replenishing with more fresh spices.

TYPICAL CATSUP FORMULA

Heavy Concentrated Tomato Pulp (Puree)	100	gal.	(Sp. gr. 1.06)
Salt	28	lb.	
Sugar	200	lb.	
Chopped Onions	25	lb.	
Cinnamon	25	oz.	
Mace	3½	oz.	
Cloves	15	oz.	
Allspice	15	oz.	
Cayenne	3½	oz.	
Chopped Garlic	4	oz.	(optional)
Ground Paprika	2	oz.	
Vinegar (100 Grain)	15	gal.	

Prepare the spice extract with vinegar, but leave out the onion, garlic, and paprika. Add these three separately. The puree is now boiled quickly, usually in an open tank. Add the sugar and towards the end add the salt. Near the end of the cook add the spice vinegar extract.

CATSUP

Tomatoes (After removing skins, seeds, and green spots)	30 lb.
Salt	1¼ to 1½ cupfuls
Redistilled Vinegar *	2¼ to 3⅓ cupfuls
Sugar	5 to 8 cupfuls

* If redistilled vinegar cannot be obtained, use 4½ to 6⅓ cups of white vinegar, 5% strength, or 6 to 8 cups of cider vinegar, 4% strength.

Spice Formula No. 1 (Mild-Spiced Catsup)

For a mild-spiced product, add to the above catsup mixture the following:

Celery Seed	3 tsps.
Mustard	3 tsps.
Cinnamon	2 tsps.
Paprika	3 tsps.
Cayenne Pepper	2 tsps.
Onions	4

Spice Formula No. 2 (Heavily Spiced Catsup)

For a heavily spiced product, add to the catsup mixture the following:

Mace	2 tsps.
Cassia	2 tsps.
Chillies	2 tsps.
Cayenne Pepper	2 tsps.
Paprika	4 tsps.
White Pepper	4 tsps.
Celery Seed	2 tsps.
Grated Garlic	¼ tsp.
Mustard	2 tsps.
Onions	8

The spicing of catsup is very largely a matter of individual taste and can, therefore, be varied at will, but at least the minimum quantities of vinegar, sugar, and salt given in the recipes must be used. The higher quantities mentioned give a heavier catsup, which does not require as much boiling to concentrate to a desired consistency. In some of the popular commercial catsups as much as 8 cups of sugar, 1⅔ cups of salt, and 4½ cups of vinegar are added to every 30 pounds of tomatoes.

To produce a catsup of proper consistency, 30 pounds of tomatoes should be boiled down to give 16 pounds of catsup. However, depending

upon whether the low or high quantities of sugar are used and upon the amount of water in the tomatoes at the start, boiling may have to be continued until the material is reduced to 13 pounds. The consistency of catsup, like the flavor, is largely a matter of personal preference.

To determine the point where boiling should be discontinued, the kettle and contents should be weighed before and after boiling:

Before boiling	
Weight of kettle	2 lb. 8 oz.
Weight of tomato juice	30 lb.
Total weight	32 lb. 8 oz.
After boiling	
Weight of catsup	16 lb.
Weight of kettle	2 lb. 8 oz.
Total weight	18 lb. 8 oz.

TOMATO JUICE COCKTAIL

Pure Fresh Tomato Juice	100	gal.
Fine Salt	12	lb.
Fine Granulated Sugar	18	lb.
Finely Ground White Pepper	¾	oz.

Add the salt and sugar directly to the tomato juice with a minimum amount of agitation. The salt and sugar are fine enough to be readily soluble. The pepper should be sifted in evenly and smoothly, to prevent the formation of clots or clumps, which are very difficult to break up.

With the above recipe as a base, any number of interesting spiced flavors can be produced. For example, any number of varieties of pepper (sweet or hot types), can be employed. Also, various types of seeds, such as caraway and coriander, can be used.

MANUFACTURE OF TOMATO JUICE

After inspection and grading, the tomatoes are dumped into sluices containing running water. They are soaked and washed, and then conveyed to an elevator which carries them to a rotary washer. This washer is an inclined cylinder made up of closely spaced bars and tubes down which the tomatoes tumble, under a spray of wash water.

From the washer, the tomatoes are passed to a conveyer belt which moves down the middle of a sorting and trimming table. Here the tomatoes are carefully picked and trimmed, only the best tomatoes being diverted to the juice plant.

In the juice plant the specially selected tomatoes are passed through a chopper. The chopped pulp is then heated by means of a tubular heater, from which it is passed to a finisher, where the juice is forced through a very fine mesh cylindrical screen to remove skin, seeds and other large pieces of solid matter. The juice is then allowed to flow to surge tanks equipped with small agitators to insure uniformity of the juice. A small quantity of salt is added to the juice in these tanks, usually about 2 pounds for each 50 gallons of juice.

From these tanks the juice is pumped into large tanks, which act as reservoirs for the homogenizers and can fillers. The homogenized juice is heated to about 200° F., by means of a tubular heater, before it is piped to the bowls of the filling machines, from which it is packed into bottles.

The bottles of juice are then sealed under vacuum and passed through water at 200° F. to insure sterilization. They are cooled and packed into cases.

PICKLES

Pickles are vegetables or fruits preserved, singly, or mixed in vinegar, mustard, brine, and variously flavored. Among the most popular are cucumbers, gerkins, mixed pickles, chilies, mango melons, cauliflower, onions, watermelon rinds, green and red tomatoes, etc.

Pickles should always be kept in a tightly covered receptacle and stored in a dark, dry place. Excessive cold and heat are harmful. While pickles in brine solution do not freeze easily, pickles in vinegar freeze almost as quickly as water. Pickles should be stirred from time to time as both brine and sweet vinegar have a tendency to sink to the bottom, leaving a dilute liquid on top. Any scum forming on the surface of the pickle brine must be removed, since it has a tendency to soften the pickles.

GENERAL CLASSIFICATION OF PICKLES

All manufactured pickles may be logically grouped in three general classes.

I. Dill Pickles
- A Fermented dill pickles
  - a. Genuine dill pickles
  - b. Genuine Kosher dill pickles
  - c. Overnight, or fresh fermented, dill pickles
  - d. Overnight, or fresh fermented Kosher, dill pickles
  - e. Polish dill pickles

- B Unfermented dill pickles made directly from fresh cucumbers
  - a. Fresh or pasteurized dill pickles
  - b. Iceberg or quartered dill pickles
- C Dill pickles made from salt stock
  - a. Processed imitation, or summer dill, pickles
  - b. Processed imitation, or summer Kosher, dill pickles
  - c. Pasteurized processed dill pickles
  - d. Pasteurized processed Kosher dill pickles

II. Sour Pickles

- A Sour pickles
  - a. Plain sour pickles
  - b. Sliced or hot sour pickles
- B Mixed sour pickles
  - a. Mixed unspiced
  - b. Spiced or hot mixed pickles
  - c. Mixed chutney
- C Relish, chow chow, etc.
  - a. Chow chow

III. Sweet Pickles

- A Plain sweet pickles
  - a. Standard sweet pickles
  - b. Midget sweet pickles
  - c. Burgherkins
  - d. Slice, chips or wafers
  - e. Candied chips
  - f. Sweet dill pickles
  - g. Bread and butter, or old-fashioned, pickles
  - h. Peeled pickles
- B Mixed sweet pickles
  - a. Plain mixed
  - b. Mustard pickles
  - c. Jamaica pickles
- C Relish, or chopped sweet, pickles
  - a. Plain relish
  - b. Spread relish
  - c. India relish
  - d. Piccalilli
  - e. Fruit relish
  - f. Mexican relish
  - g. Vegetable relish

DILL PICKLES

A general definition of dill pickles includes pickles, either fermented or unfermented, to which have been added dill flavoring, in the form of fresh or cured dill weed or oil of dill, salt, vinegar or lactic acid (the lactic acid may be produced either by fermentation of the pickles or by the addition of edible lactic acid) and mixed spices.

GENUINE DILL PICKLES:

Genuine dill pickles are pickles produced by the natural fermentation of fresh cucumbers to which have been added from 9.54 to 10.6 percent of salt (36° to 40° salometer brine), 10 to 15 pounds of cured dill weed per barrel, mixed spices (about one pound per barrel) and one quart of 100 grain vinegar (vinegar may or may not be added).

It requires from three to six weeks for the pickles to cure thoroughly and for the fermentation to be completed. When properly made, genuine dill pickles should contain 7 to 12 grains acid (expressed as lactic acid) 4.25 to 5.3 percent salt (18° to 20° salometer). There should be present a primary flavor of dill and a secondary flavor of the mixed spices. To retain the flavor of the natural fermentation, genuine dill pickles should be marketed in the original brine. This can be done only by selling them in casks, barrels or glass, in which they are packed in the original brine, a practice which has been largely discontinued due to the growth of the scum yeast. Mycoderma, which oxidizes the acid, subsequently leads to a loss of flavor and softening of the pickles; genuine dill brine may also become cloudy from the presence of microorganisms, soil particles and other debris present.

There are several ways by which the cloudiness may be over-come. First, by filtering the brine or by packing the pickles in colored glass containers and stating on the label that the pickles are packed in the original milky brine in order to retain the original flavor. Another and less satisfactory method is to discard the original brine and make up a synthetic brine simulating the original brine in acidity, salinity and spicing, adding it to the genuine dill pickles. This is an easy way out but this synthetic brine lacks the real flavor of the original brine and, therefore, detracts from the flavor of the pickles. This doubtless accounts for the decline in the popularity of genuine dill pickles. This condition is to be deplored since the genuine dill pickle is the "champagne" of pickles. Likewise, the hazards attending the making and marketing of genuine dill pickles has led to the many substitutes for them.

Fabian has shown that scum formation on the surface of genuine dill brine can be prevented by the addition of a few drops of mustard oil or

by covering the surface with paper or other material impregnated with mustard oil. If this were done, it would still be possible to market genuine dill pickles in open casks or barrels as was formerly the practice.

POLISH DILL PICKLES:

Polish dill pickles are pickles made from fresh cucumbers which are fermented in a low salt brine. The fresh cucumbers are placed in 5.3 percent (20° salometer) salt solution at first, rather than in a 40° salometer brine as in genuine dill pickles. The finished pickles contain about two percent salt and test four to six grains of acid. The spicing is about the same as for genuine dills except for the addition of onions, garlic and red peppers. The better brands of Polish dills are completely fermented. Some of the cheaper brands are not.

Some type of treatment is necessary to preserve them since the salt and acid content is low. Sodium benzoate is used in some cases while in others pasteurization at 165° F. for 30 minutes is employed. The latter method is preferable since benzoate, in the presence of acid, results in a burning sensation in the mouth after tasting or eating the pickles.

Polish dills were very popular when introduced into this country. This doubtless stimulated American manufacturers to simulate them, leading to the greater variety of pickles, some of which are superior to many of the Polish dills.

OVERNIGHT, OR FRESH FERMENTED DILL PICKLES:

Overnight, or fresh fermented, dill pickles are pickles produced by the natural fermentation of fresh cucumbers to which have been added 5.3 percent salt (20° salometer brine), 10 to 15 pounds of cured dill weed, one pound of mixed spices and (with or without) one quart of 100 grain vinegar per barrel.

The length of the fermentation period varies from several days to one week. Frequently the pickles are placed in a cold place or in cold storage, where some fermentation takes place (usually only partial fermentation takes place before consumption). When they are removed from the cold and placed in the store in a barrel, fermentation continues at a more rapid rate unless sodium benzoate is added.

The short fermentation period leads to the name "overnight" dill pickles, although some people prefer to call them "fresh fermented" dill pickles. The finished pickle has about two percent salt and an acidity between three and five grains.

Since the salt and acid content is so low, it is obvious that this type of pickles is very perishable. They must be sold within a short time if marketed in barrels; if canned, they must be heated. The safe pasteur-

izing temperature to use is 165° F. for 30 minutes; the addition of 0.1 percent sodium benzoate cannot be relied upon to keep them.

KOSHER DILL PICKLES:

The term "Kosher," as commonly used, simply implies a more highly spiced pickle, especially with respect to garlic, onion and peppers. These should be labeled "Kosher style" pickles to be correct. The term "Kosher" should be applied only to dill pickles of any type—genuine, overnight, fresh fermented, pasteurized, etc. which contain garlic and other spices and which have been prepared according to the Hebrew ordinances. Thus, we may have Kosher style genuine dill pickles, which would differ from genuine dill pickles only in the flavoring; a "Kosher" genuine dill pickle would differ only from the "Kosher style" genuine dill pickle in that the former had been prepared according to the Hebrew ordinances with the assistance of a Rabbi while the latter had not.

FRESH OR PASTEURIZED DILL PICKLES:

Fresh or pasteurized dill pickles are unfermented pickles made by placing fresh cucumbers in a weak brine (20° salometer), containing 5.3 per-cent salt and about 8 to 10 grains of acetic acid. They are flavored with dill oil and 4 to 6 the essential oils; oil of garlic and pepper may be added if these flavors are desired; also, from ½ to 3 per cent sugar. Cured dill weed and whole spices may be used if desired. It is quite common to find a sprig of dill weed, mustard or pepper seed present and the other spices added in the form of oils. A small red pepper may be added for flavor and to improve the attractiveness of the jar. The addition of other whole spices is not recommended, as they detract from the appearance and flavor of the pickles.

Since these pickles are unfermented, it is necessary to preserve them. Chemicals, such as sodium benzoate, are unsatisfactory for this purpose. Pasteurization at 165° F. for 30 minutes is the most satisfactory method to use.

In commercial practice, fresh cucumbers, ranging in size from three to five inches, are washed and packed tightly inside glass jars. The glass jars are then filled with the brine, capped and pasteurized. The pickles are not cured and therefore have the flavor of fresh cucumbers, in addition to the flavor of dill and other ingredients present. They are very palatable and appetizing.

Since the curing and flavoring is all done inside the jar on the fresh cucumber, it is very important that the ratio of the brine to the cucumbers be kept practically constant. The amount of salt, acid and spicing

is also important in this connection if the flavor of the finished pickle is to be satisfactory.

Iceberg or quartered dill pickles are the same as fresh or pasteurized dills except that the ends of the fresh cucumbers are cut off, after which they are quartered before being packed in the jars. Larger sizes are cut into six or even eight pieces. Twenty degree salometer brine (containing from 8 to 10 grains of acetic acid and the spicing in the form of oils) is poured over the pickles in the jars. A spring of dill weed, mustard seed and one small red pepper are added. The jars are then pasteurized at 165° F. for 30 minutes. The pickles should contain from 2 to 2¼ percent salt and 4 to 5 grains of acid when finished.

PROCESSED DILL PICKLES:

Processed dill pickles ("imitation" or "summer" dills) are pickles made from cured salt stock by the addition of a brine (simulating dill brine) which is made by heating dill weed and whole spices in the brine or by the addition of the essential oils to the brine or both. There is considerable variation in the analysis of the finished pickles, the salt content ranging from 3 to 4¼% and the acidity from 5 to 10 grains.

In making this type of pickle, the salt stock is freshened and processed with turmeric and alum. Then the processed pickles are placed in a 20° salometer brine containing about 17 grains of acetic acid, dill weed or dill oil and whole spices or dill flavored brine (prepared as previously described). The pickles are allowed to stand in the brine for several days or longer; it has been found that the cloudiness, which sometimes appears in the brine after the pickles are placed in jars, is due to the presence of micro-organisms. There are three principal causes of cloudiness in this type of pickle. One cause is low brine acidity which permits the growth of micro-organisms. Dirty barrels, or barrels containing sugar, sometimes are at fault. Frequently the condition has been eliminated by using the oil flavors instead of dill weed and whole spices, to eliminate the possibility of contaminated spices. Any one, or combination of, the above conditions is almost certain to lead to cloudiness.

While processed dill pickles are not fermented (as in the case of other types of dill pickles), they are made from salt stock which has previously been fermented and cured. In this way they differ from all the other types of dill pickles previously discussed.

Processed, imitation, or summer Kosher, dill pickles are processed dill pickles which have been treated in the manner previously described under Kosher dill pickles.

PASTEURIZED PROCESSED DILL PICKLES:

Pasteurized processed dill pickles are pickles made from salt stock pickles by freshening and processing them in the usual manner. They are then placed in a weak brine containing 5.3 per cent salt (20° salometer), about 8 to 10 grains vinegar and are flavored with dill oil and 4 to 6 other essential oils. Oil of garlic, onion and pepper may be added if desired, also from ½ to 3% sugar if a slightly sweet taste is preferred. A sprig of dill weed and a small red pepper may be placed in the jar when the pickles are packed to add to their attractiveness; whole spices have not proved satisfactory. The filled jars should be pasteurized at 165° F. for 30 minutes to insure lasting qualities.

There has been such a demand for the fresh (or pasteurized) dill pickles that it has been difficult to make enough of this type of pickle during the short cucumber season from fresh cucumbers. For this reason, some pickle packers have been using salt stock pickles instead of fresh cucumbers to meet the demand after the supply of pickles made from fresh cucumbers has become exhausted. The pasteurized processed dill pickles, however, lack the flavor of fresh cucumbers but are otherwise satisfactory.

Pasteurized processed Kosher dill pickles are the same as pasteurized processed pickles except that they are treated in the same manner described under Kosher dill pickles.

SOUR PICKLES:

Sour pickles are pickles containing from 2 to 4% salt and 18 to 20 grains of acetic acid. They are prepared from salt stock by freshening and processing cucumbers which have previously been fermented and cured in salt brine. The final salt concentration of the brine stock at the end of the curing process ranges from 13.25 to 18.55% salt (50 to 70° salometer). In practice the salt is withdrawn from the pickles by placing them in fresh water until the desired amount of salt has been removed. The amount of salt left in the pickles is sufficient so that, when they are subsequently soured (by placing them in 50 grain vinegar), from 2 to 4% salt will be present.

Spiced (or hot sour) pickles are made in the same manner as sour pickles except that mixed pickling spices and Chili peppers are added to them.

Sour mixed pickles are pickles containing freshened and processed salt stock pickles, cauliflower, onions, sweet peppers and spices. They are made from the cured salt stock of all the above ingredients and contain the same amount of salt and vinegar as sour pickles.

Sour spiced (or hot mixed pickles) are the same as sour mixed pickles except that spices and hot peppers are added to them. The spices may be added whole or in the form of the oils.

CHUTNEY:

Mixed chutney consists of cured and freshened cut pickles, cauliflower and pearl onions, seasoned with lemon peel and sliced lemons, coriander and celery seed, Japanese chilies, oils of cassia and cloves. It should test 21 to 22 grains of acetic acid, 18 to 20° Baume and 2% salt. Sometimes cut mangoes and Burr pickles are added to the above ingredients, especially if the product is to be sold in cans.

CHOW-CHOW:

Chow-chow is a combination of freshened and processed salt stock pickles, cauliflower and onions. The above ingredients are cut and covered with a chow sauce, consisting of yellow and brown mustard seed, turmeric, garlic, cinnamon, cloves, ginger, nutmeg, cayenne, black and white pepper and vinegar.

SWEET PICKLES:

Plain sweet pickles are pickles made by freshening and processing cured salt stock and then adding sugar, vinegar and spices to the freshened pickles. The sugar content of the finished pickles ranges from 12 to 22° Baume (21.7 to 40° Brix), the acidity from 20 to 28 grains (calculated as acetic acid), and the salt from 1 to 2%. Spices may be added either whole or in the form of the oils.

Sweet pickles containing less than 20 grains of acid will spoil unless sodium benzoate is added to them or they are pasteurized. The amount of sugar added (within the given ranges) is purely a matter of cost and flavor, although the general tendency is to lower the sugar content of pickles to lower costs. Only minute traces of spices are necessary to produce the best flavored pickles, the combination and manner of incorporating the spices being of prime importance.

Standard sweet pickles are pickles ranging in size from 10,000 to 2,700 per forty-five-gallon barrel. They conform to the general specifications for plain sweet pickles just given.

Midget sweet pickles are pickles which are smaller than the 10,000 size, but otherwise conform to the general specifications for plain sweet pickles.

Burgherkins are a species of the cucurbit family, which are processed and finished in the same manner as the pickling variety of cucumber and which conform to the general specifications for plain sweet pickles. How-

ever, they must be sweetened slowly and over a longer period of time than ordinary pickles, because of the shriveling action which accompanies all sweetening.

Slices, chips or wafers are plain sweet pickles that have been cut crosswise in thin rings. Considerable loss results from the marketing of this type of pickles due to shrinkage in packing and the extra labor involved, unless costs are carefully figured.

Candied chips are sliced sweet pickles containing 11–16 grains of acetic acid, 24 to 28° Baume of sugar (44–52° Brix), 1.5 per cent salt and suitable mixed spices (either whole or in the form of the oil). Due to the low acidity and high sugar content, this variety is sweeter than ordinary sweet pickles. The high concentration of sugar helps to preserve these pickles, so that it is safe to have low acidity without pasteurization.

Sweet dill pickles are the same as candied chips except they are made from genuine or processed dill pickles, instead of salt stock pickles, and are sliced lengthwise, instead of crosswise. Sometimes they are made from salt stock pickles with the addition of dill weed flavor.

SPICED PICKLES:

Spiced peeled pickles are made by peeling large salt stock pickles and freshening and processing the peelings. They are then treated with vinegar and sweet spiced liquor. The finished product is similar in taste to spiced watermelon or canteloupe.

BREAD-AND-BUTTER PICKLES:

Bread-and-butter (or country-style) pickles are made from fresh cucumbers and onions. They are washed, sliced into chips and placed in a 25° salometer brine for 4 to 12 hours. They are then placed in jars, to which is added a heavy spiced syrup containing mustard and celery seed; the jars are then heated to 170° F. for 25 minutes. The finished product usually tests from 10 to 16° Baume (18 to 29° Brix), eight to 17 grains acidity, and from 1 to 2.5% salt. There are other methods used in making this variety, such as cooking the fresh cucumbers in a weak sweet liquor and then placing them in jars with the addition of a heavy sweet liquor and further heating to prevent spoilage.

Plain mixed sweet pickles are a combination of freshened and processed salt stock pickles with cauliflower, onions, and sweet peppers. They contain from 21 to 22 grains of acid, 18 to 20° Baume of sugar (22.6–36.3° Brix), 1.5% salt and spices as desired. Due to the cut surfaces of the ingredients, this variety should contain more acetic acid than whole sweet pickles, in order to keep them from spoiling.

MUSTARD PICKLES:

Mustard pickles, or sweet chow-chow, is a combination of cured, freshened, processed and sweetened cut pickles, cauliflower, onions and sweet peppers. They contain 21 to 22 grains of acetic acid, 18 to 20° Baume of sugar (32.7–36.4° Brix), 1.5% salt, suitable spices and yellow ground mustard.

JAMAICA PICKLE:

Jamaica pickle is a type of mixed pickle made from preserved ginger, cut cauliflower, pickles, onions, Valencia raisins, lemon, orange and citron peel, brown sugar and vinegar. To this mixture is added a cooked sauce composed of ground cauliflower, tamarinds, tomato pulp, dates, Canton soya, old orange marmalade spiced with powdered spices such as mace, cardamon seed, celery seed, ginger, curry, and flavored vinegars such as cider, garlic and shallott vinegar. It is then sweetened with brown and granulated sugars, colored with caramel and thickened with gum arabic. The finished product is bottled and processed at 180° F. for 15 to 20 minutes.

PLAIN RELISH:

Plain relish is a combination of cured, freshened processed pickles, green tomatoes, cauliflower stocks, red peppers and white onions; cabbage and/or green tomatoes are sometimes added. The finished product contains from 22 to 23 grains of acetic acid, 18 to 20° Baume of sugar, 1.5 to 2.5% salt and spices.

The acid content of sweet relish should be 2 to 3 grains higher than for uncut materials, due to the cut surfaces, to prevent spoilage.

SPREAD RELISH:

Spread relish is a plain relish which is soured to 27 to 30 grains acid. This is mixed with salad dressing or mayonnaise, so that 40 to 60% of the sandwish spread is made up of relish. Relish used for salad dressing should test from 27 to 30 grains acid, 18 to 21° Baume and 1.75 to 2.75% salt. The excess juice should be drained from it so as not to dilute the salad dressing. If these precautions are not taken, fermentation results.

INDIA RELISH:

India relish is a combination of cured, freshened and processed pickles, green tomatoes, cauliflower stocks, white onions and red bullnose peppers. The finished product contains 22 to 23 grains of acetic acid, 18 to

20° Baume sugar, 1.5 to 2.0% salt, and suitable spices (usually ground ginger, nutmeg, celery and yellow mustard seed).

FRUIT RELISH:

Fruit relish is a relish used for stuffing fruits and melons. It is made from plain (or any other type) relish by addition of currants, citron, orange and lemon peel, and sugar. This mixture is cooked for 15 to 20 minutes and is ready to use.

PICCALILLI:

Sweet piccalilli is made from sliced green tomatoes, onions and sweet pickles, to which is added a sweet spiced liquor consisting of sugar, vinegar and spices. The mixture should be pasteurized at 165° F. for 30 minutes.

VEGETABLE RELISH:

Vegetable relish is a mixture of plain relish, ground fresh cabbage, red peppers, additional turmeric, mustard and celery seed, regular pickling spices and sufficient sugar to test 12 to 15° Baume (21.6 to 27.1° Brix), acid to test 12 to 15 grains and 1.5 to 2.5% salt. The product must be either pasteurized or sodium benzoate added.

MEXICAN RELISH:

Mexican relish consists of freshened red chili peppers, chopped processed pickle nubs and crooks, cauliflower stocks, chopped ripe olives and green tomatoes, to which is added a sweetened liquor made from sugar and distilled vinegar. All ingredients are cooked except the peppers. Sodium benzoate is added and it is bottled hot.

PICKLE SPICING

Practically all manufacturers have their own spicing formula which they use. In some cases as in genuine dill pickles, whole spices are used. Not infrequently a combination of whole spices and oils is used, e.g., in fresh dill pickles, processed dill pickles and some types of sweet pickles. Again, only the oils and oleoresins (resins of the spices), are used, e.g., in certain types of sweet pickles.

The oils and oleoresins of spices are practically insoluble in water; therefore, it is necessary to put them in solution with some substance which is soluble in the pickle liquor. Alternatively, an emulsion of the oils and resins with some emulsifying agent, such as gum tragacanth or arabic, can be made and the spices added to the pickles in this form.

Spicing is important in the pickle industry if a good flavored pickle is to be produced, although space will not permit going into detail on this phase of the subject. However, some idea may be gained of the number of spices used in a formula from the following mixed spice for pickles. Spices used are; allspice, coriander seed, cassia No. 2 broken Batavia, cloves-Zanzibar, Jamaica ginger-broken, bay leaves-broken, mace Penang, cardamom seed, E. D. long peppers, yellow mustard seed, black pepper No. 2, Japanese chilies No. 1.

The proportion of each of the above spices in the formula is as important as the individual spices, a predominance of any one of the spices giving an undesirable flavor. Equally important is the amount of spices added to the pickles, since too much spicing will ruin the finest pickles produced.

One thing is certain about any good spice formula, that it must contain some of the heavy oil spices, such as cloves, cassia, allspice or pimento, and some of the light oil spices, such as nutmeg, ginger, thyme, cardamon, orange, lemon, etc. A proper blending of the light with the heavy oil spices gives the ideal spicing mixture, whether it consists of whole spices or oils.

CHAPTER VIII

FISH, FRIED FOODS, HEALTH FOODS, NUT PRODUCTS

The annual catch of fish in the United States (including seas, lakes, and rivers), averages more than three million pounds, most of which is consumed in this country. The loss in dressing (throwing away unused parts) may vary from 15 to 50% of the total weight. In addition, this country imports roughly two to three hundred million pounds of fresh, salted and canned fish.

Fish is a food rich in proteins and fat, has excellent nutritive values and is easily prepared and cooked. Due to the abundance of the many varieties of salt and fresh water fish, it is also an inexpensive food. Both salt and fresh water fish are equally wholesome and nutritious, and distinctively flavored. Fish is very similar to lean beef in its food composition. Among the fish most abundantly supplied with fat are butter fish, gray fish, herring, mackerel, salmon, shad, trout and tuna. The digestibility of fish varies with the different kinds, it being general opinion that fish of a fine texture are more easily digested and that fresh fish are more easily assimilated than smoked or dried. Canned, uncured fish corresponds very closely in digestability to fresh fish of the same variety. Freshness is essential; the flesh should be firm, the skin and eyes bright, and the meat should not be so soft that the pressure of the finger leaves a mark. Unless the fish is used immediately it is kept best by submerging in fine cracked ice. For commercial shipment and storage fish should be quickly frozen to about 5° F. (or lower if possible) and held thereafter at the lowest possible point, between 0° and 15° F.

Dried, salted, smoked and pickled fish should be kept out of the sun and as cool as possible. Pickled fish should always be kept submerged in the pickling brine. If the brine dries out or leaks away, it should be replenished with new brine.

The advertisement of the use of principal food fishes is continually being conducted in the United States, under the jurisdiction of the United States Bureau of Fisheries, assisted by the State Fisheries Commission, sportsmens' associations and clubs. The United States Bureau maintains hatcheries along the coast in the chief shad and salmon rivers and at various points along the Great Lakes. Subsequently, the young fish are

distributed in natural spawning grounds of the immediate vicinity and great quantities are shipped to all parts of the country, for replenishing of ponds, rivers, lakes; a small percentage is brought to maturity for breeding purposes. The young spawn fish are called "fry" while the larger ones (still small) are called "fingerlings." In distributing the "fry" and "fingerlings" overland, the fishery bureau operates many special constructed railway cars equipped with air pumps and other required appliances for transportation of living fish.

A. SALT WATER FISH

Anchovies
Bass
Blackfish
Bluefish
Bream
Cod
Eel
Gurnet
Haddock
Hake
Herring
John Dory
Lafayette
Ling
Kingfish
Mackerel
Marlin
Mullet (Gray)
Mullet (Red)
Pollack
Porgy
Red Drum
Sheepshead
Smelts
Snapper
Sprat
Tuna
Tunny
Weakfish
Whitebait
Whiting

FLAT SALT WATER FISH

Brill
Flounder
Fluke
Halibut
Plaice
Skate
Sole
Turbot

B. FRESH WATER FISH

Carp
Bass, Striped
Bass. Otsego
Bass, Black
Bass, Oswego
Perch, White
Pike (Pickerel)
Roach
Salmon
Sturgeon
Tench
Trout

C. SALT FISH

Anchovies	Haddock
Bloaters	Herring
Cod	Kippers

D. SHELL FISH

Clams	Oysters
Cockles	Prawns
Crabs	Scallops
Crayfish	Shrimps
Lobster	Winkles
Mussels	Whelks

E. CANNED FISH

Bonito	Salmon
Caviar	Sardines
Crab	Shrimp
Lobster	Tuna

Fish with less than 2% of fat are known as "White Fish" and are very suitable for invalids.

Among these fish are

Cod	Plaice
Flounder	Skate
Haddock	Sole
Ling	Turbot
Pike	Whiting
Pickerel	

"Fat" or "Oily Fish" with more than 5% of fat include

Eel	Mackerel
Haddock	Salmon
Herring	Trout

HOW TO TELL WHEN FISH IS FRESH

1. In fresh fish the eyes are bright.
2. In fresh fish the gills are red.
3. In fresh fish the flesh is firm and odorless. The flesh springs back when pressed with the finger.

Put fish in water and if it sinks it is fresh. If it floats it is a sign that it is not fresh and it should certainly not be used.

A. SALT WATER FISH

ANCHOVY

A small bony fish of the herring family about 6 inches long, found in European waters, mainly in the Mediterranean Sea.

BASS

The sea bass found in the bays as early as May is a small fish, averaging ½ or ¾ pound. They are dark brown in color. In June the larger bass is caught. They are generally dark blue or indigo with black predominating in a checker effect. They reach 4 to 5 pounds.

BLACKFISH

A name given to different fish, as the New England Tautoc, the sea bass, and some others. Blackfish are found from the Jersey Coast to South Carolina. They average from 3 to 8 pounds; occasionally larger fish are caught. In season spring and fall.

BLUEFISH

Also called snapping mackerel, tailor, greenfish, fat back, and snapper. They are common along the Atlantic Coast from Nova Scotia to Brazil. Bluish in color, large (from 6–15 pounds) and voracious. In season July to November. Excellent food value.

BREAM

Allied to the carp.

COD

The cod inhabits the northeastern seas and is also found in enormous quantities off the coast of Newfoundland and the shores of New England. They grow to 40 to 50 pounds in weight and are very prolific, a single fish producing from 2 to 9 million eggs. The small or baby fish are termed "Codling" and are found close to the shore.

Cod are named from the place where found, the nature of their food, etc., as shore cod, bank cod, rock cod, George's cod (caught in the vicinity of George's banks, a fishing ground off the coast of Maine). Cod comes into season about the beginning of October, but are considered at their best about Christmas time, and out of season by the middle of March.

EEL

A fish distributed in almost all fresh waters and seas of the temperate and tropical zones, valuable for its nutritive properties. Eels bite best in spring and fall. When the weather is mild they are caught as late as December, but with the first approach of cold weather they burrow into the mud, where they stay until spring.

The Conger eel is well known on all rocky parts of the British Isles. Some of them are very large specimens, measuring 10 feet in length, 18 inches in girth, and weighing over 100 pounds.

GURNET OR GURNARD

A spiny fish, several species inhabiting the North Atlantic coasts.

The red or cuckoo gurnard frequents the English shores.

They are known by their scaly body, compressed laterally. The head is very much broader than the body, the upper jaw extending beyond the lower. The eyes are near the top of the head, large and prominent.

The gurnet is a nicely flavored fish with firm, white flesh.

HADDOCK

The haddock inhabits the Arctic seas to about the Bay of Biscay on the European coast and to Cape Hatteras on the American side. They do not reach a very large size, 8 pounds being about the biggest, have a long body, the upper part of a brown color, a silvery belly, and a black spot on each side just behind the head.

Either fresh or smoked, it forms an excellent table dish. Its flesh is firm and sound, white in color, with a creamy curd between the flakes. The larger the fish the firmer the flesh. If it can be boiled in seawater the flavor is perfection. The haddock is in season nearly all the year round, but it is at its best in March and April. The finest and those which are held in the greatest esteem come from Finnan in Kincardineshire, Scotland. They are generally recognized by their odor and creamy dark yellow color.

HAKE

This fish belongs to the division of codfish. Its shape is not unlike a pike and on account of its voraciousness it is called the "sea pike." The hake is sometimes 3 or 4 feet in length, weighs about 5 pounds, and is of a whitish color, grayish on the back. The fish is rather migratory and found in all temperate and moderately cold waters. Frequently sold under the name of "rock salmon."

Its flesh is very solid and is better if baked or fried than it is boiled. In season during the summer months.

HERRING

This is one of our most abundant fish, found in all northern seas not far from the land. The common herring is found throughout the north Atlantic, the California herring in great numbers in the north Pacific. The herring is distinguished by its brilliant silver color, small fins, and deeply forked tail. They arrive at our shores about the end of May, and average about 1 pound; in October a larger herring, weighing as high as 2½ pounds, arrives and often stays to December. This is the "hickory shad," better known as fall herring or shad herring. They travel in large shoals and their appearance is marked by certain signs, such as the number of birds and others which follow the shoals to prey on them.

The herring is an important food supply and herring fisheries constitute a valuable industry.

JOHN DORY

In the United States and Canada this name is applied to the wall-eyed pike.

In European seas, especially off the Devonshire and Cornish coasts, the name is applied to a fish of a yellowish golden tint. The name is derived from the French words jaune doré, meaning yellow gilt. It is not a very common fish, and consequently rather expensive. Its flesh is not unlike that of the lobster's claw. The best fish are those weighing between 5 and 6 pounds, which should be boiled on account of the high quantity of oil they contain.

LAFAYETTE

Also called "spot," "goody," or "oldwife," a bottom fish resembling the perch, weighs rarely more than a few ounces, abounding from Cape Cod to Texas. It is of a bluish silver hue with about 15 wavy transverse bands.

The name is applied also to the butterfish, harvest-fish, and dollar-fish. They generally arrive in July and stay till October.

LING

This fish belongs to the family of the cod and is a native of the northern seas of Europe. It is not unlike the cod in form but more slender. It grows to a large size, varying from 5 to 7 feet in length. Its liver yields more oil than the codfish. The flesh is firm and very white

and better fried or baked than boiled. In the west of England very good pies are made with the ling.

In the United States the name ling is applied to a hake. They average about $2\frac{1}{2}$ pounds. Ling are most plentiful in spring and fall, but can be caught all the year. They come into shore at night to feed along the surf.

KINGFISH

A fish caught on the Atlantic coast; from the Chesapeake to Virginia the kingfish is quite common. They are generally small, rarely exceeding 12 inches in length, weighing about 1 pound, but occasionally running to 3 to 4 pounds.

Kingfish are beautifully marked in a sort of two-tone brown with wormlike dark marking on the back and sides. They are excellent food fish and have a delicate flavor. In season June, July, and August.

MACKEREL

Mackerel are distributed in practically all parts of the world, and seem to be as abundant in one part as another. Their habits are similar to the bluefish. They move in large shoals, and although not the wanton killers that bluefish are, they do destroy a large number of fish. The mackerel is well known for its beauty, brilliancy of color, elegance of form, and its value as an article of food. They vary in length from 14–16 inches and in weight from 1–3 pounds, but very often larger fish running from 3–6 pounds are caught.

They are best as an article of diet when caught in the months of May and June, and are considered superior in flavor to those caught in spring or autumn.

Mackerel must only be eaten when very fresh, because they become unfit for human food more quickly than any other fish. Those with the least amount of roe and of middle size are the best in flavor. The mackerel fishery of the world ranks in importance with the cod and herring.

MARLIN

Also known as "spearfish," a large fish of the swordfish family.

MULLET

(Gray)—A fish most abundant on the sandy shores of England, ascending the rivers for many miles.

The best are the medium-sized fish, about 9 inches long. The flesh is exceedingly delicate and has a nice flavor of the sea.

The gray mullet, unlike the red mullet, must be scraped, emptied, and thoroughly cleaned. It should be purchased as fresh as possible.

(Red)—The red mullet has been highly esteemed from time immemorial. The ancient Romans used to pay an extravagant price for it. The red mullet frequents the shores of England, particularly the Cornish and south coasts. The fish is always in great demand, the flesh being firm, white, and well flavored. They are considered in perfection when the roe is forming and that is generally in the summer. Unlike other fish, they are dressed without being gutted, and by being kept for a day or two their flavor is so improved that they are often termed "sea woodcock."

POLLACK

A fish of the cod family, also known as "coal fish" or "green cod," is found in the north Atlantic. The pollack, like the codfish, reaches great size. Specimens 4 feet long have been recorded.

PORGY

Also called "scup," "scuppang," is a small fish, rarely averaging more than ¼ pound, and resembling the sheepshead. They are found on the Atlantic coast from Cape Cod to Florida. Porgies arrive in June and are caught until October. They are highly valued for food.

RED DRUM

Also known as "channel bass," "redfish," "drum," "red bass," "rief bass," "red horse," range along the Atlantic coast from New Jersey to Texas. They belong to the same family as the weakfish, but do not resemble them. They run along shore in July and August, and reach weights up to 60 pounds. The "black drum" is related to the red drum, but not as handsome as the latter. They reach weights up to 100 pounds.

SHAD

A small fish belonging to the herring family, but growing from 20 to 30 inches in length.

SHEEPSHEAD

Resemble the blackfish. They sometimes reach a weight of 15 pounds, but average about 3 pounds. This fish is now scarce on the Atlantic coast north of Virginia, while in the waters of Florida sheepshead are abundant.

SMELT

A genus of fish belonging to the salmon family. They inhabit the salt water about the mouths of rivers from August till May, and return to the sea after spawning in March. The American smelt is found on the coasts of New England. It does not exceed 12 inches in length. When freshly taken from the water there is a strong cucumber-like smell from this fish. The smelt is eaten in enormous quantities in Paris, as they are abundantly taken from the river Seine. The French word for smelt is éperlan.

SNAPPER

The young bluefish.

SPRAT

A fish of the herring family, rarely exceeding more than 4 or 5 inches in length. Very abundant on the coasts of Great Britain, where they visit the shores after the herring and other fish have departed. They are dried and salted and sold in the market as "kilkies," also as "Norwegian anchovies."

TUNA OR TUNNY

A fish belonging to the mackerel family, sometimes attaining a length of 10 feet and a weight of over 1,000 pounds.

On the Atlantic coast this fish is known as "the great horse mackerel," on the coast of California as "tuna," and in the Mediterranean, off Spain and Italy, where they are very abundant, as "tunny."

July and August are the best months for tuna fishing, when they may be caught at almost any point between Montauk Point and Cape May from 6 to 30 miles off shore.

The albacore is shaped like a tuna, its body marks differing.

A relative to the albacore is the Arctic "bonito," both practically alike, weighing up to 20 pounds, dark red meat, strong in taste.

WEAKFISH

Or "sea trout," are caught in large numbers from May to October along the shores of the Atlantic coast from Cape Cod to Florida. They run from ½ to 10 pounds.

WHITEBAIT

A small fish, 2 to 5 inches long. Abundant in the river Thames during spring and summer, much prized by Londoners.

WHITING

Also known as winter weakfish, frost fish, and silver hake. They are called whiting because of their pearly silvery whitness. They arrive in October or November in shoals that generally contain a few hundred fish. The usual weight of a whiting is from 1½ to 2 pounds in shore, but those found in deep water have scaled as much as 6 to 7 pounds in weight. They are considered a very fine table fish, and, because of being easily digested, are sought after for invalids. They are free from oily matter, and are very nutritious.

FLAT SALT WATER FISH

BRILL

A European fish, found in most parts of the British coasts, but more plentiful in the English Channel. The brill is similar to the turbot in form, but inferior to it in size and quality. Its skin is perfectly smooth, of a pale, yellowish brown color with reddish-orange spots, and covered with moderate sized scales.

FLUKE

A species of flatfish, much like the common flounder. From June to November found almost everywhere from Cape May to Montauk Point. They average about 2 pounds, but fish running from 5 to 15 pounds are sometimes caught.

FLOUNDER

A small flatfish, with an oval, strongly compressed body, and with both eyes in the adult on the same side of the body. The so-called winter flounder, dark brown in color, is caught on the Atlantic coast in winter and early spring. They are inferior to the brill and plaice, but are easily digested when fresh. Flounders rarely exceed 20 inches in length and 5 pounds in weight.

HALIBUT

(Holy butt—holy flounder, so called because eaten particularly on holy days.)

This is the largest of all flatfish, some of them turning the scale at 120 pounds; the best for food purposes are, however, those weighing from 30 to 40 pounds. The halibut is found along both shores of the northern Atlantic and northern Pacific. It has an elongated, thick body with a

broad head, both eyes on the upper side, and a large mouth. The upper surface is covered with small dark brown scales, the under surface smooth and white. The flesh is delicate, very wholesome, and much resembles the turbot. In fact, it is the poor man's turbot.

PLAICE

A valuable European flatfish found in the Baltic and Mediterranean, but in largest quantities in the North Sea.

The eyes of the plaice are on the right side, the skin grayish brown, and, when perfectly fresh, large orange colored spots are found on the skin. As the fish gets stale, the spots darken until they become black, when the fish is bad. The plaice usually measures less than 2 feet and weighs from 8 to 10 pounds.

SKATE

This is a fish of the ray tribe, extremely abundant and widely distributed over temperate seas, especially in the north. The common skate of Europe often attains a weight of 200 pounds. The barn door skate of the United States is about 4 feet long.

The flesh is thick and very nutritious, but it is more appreciated by the French, who value it as a very nutritive fish. This fish varies in quality more than any other fish. The finest are those which have broad and thick backs. The dark side should be brown and healthy looking and the underneath a delicate creamy white. The young skate are called "maids" and are very tender and delicate, but the larger are more profitable, having more flesh.

SOLE

The sole holds a prominent position among the flatfish. It is second only to the turbot in point of excellence and is highly esteemed for its firm, white, and delicate flesh. Sole—the European flounder—is distinguished by the eyes being on the right side, by its oblong form with a rounded muzzle. They vary in size from the little delicate morsels called "slips" to the larger ones weighing from 4 to 7 pounds. Those that are caught in the shallow waters are the smallest, and are really the best in flavor.

The color of the sole depends greatly upon the ground where they feed. If light in color, the skin is light and they are called "lemon soles," but if they feed on muddy shores, they are called "black soles."

The flesh of the sole is easily digested.

TURBOT

This fish may be termed the king of flatfish. Epicures have appreciated this fish from the remotest time. No classic feast in ancient Rome or Greece was complete without the turbot. The adult turbot is about 24 inches in length and has been known to scale 30–40 pounds. The largest supply comes from the North Sea. An American species, the "spotted turbot" or "windowpane," is common on the New England coast.

The turbot is distinguished by having the eyes on the left side, a broad diamond-shaped body, no scales, sandy colored skin, beneath which lie little bony tubercles.

B. FRESH WATER FISH

BASS

One of many species of valuable food fish, both fresh and sea water fish, allied to the perch, and abundant in the inland waters of the United States.

The varieties include:

- The Striped Bass
- The Otsego Bass (Otsego Whitefish)
- The Black Bass (Oswego Bass)
- The Grass Bass
- The Red-eye Bass (Rock Bass)
- The Calico Bass

CARP

A long, large-scaled fresh water fish, native of China, with a compressed body and a rather small mouth, furnished with four barbels. This fish is largely used as food, and bred in ponds. It breeds rapidly, grows to a large size, and lives to a great age. The carp is generally dark brown in color, from 12 to 17 inches long, and weighs about 20 pounds, often more.

PERCH

The common perch, a fresh water fish with powerful fins, sharp spines, is found in clear rivers and lakes throughout the whole of temperate Europe. In America the yellow perch is best known. It is an excellent food fish.

The name of perch, however, is given to many other salt or fresh water fish, as

Black Perch (Black Bass)
Gray Perch (The fresh water drum)
Red Perch (The rosefish of the north Atlantic or the Garibaldi of California) and others.

PIKE

A voracious fresh water fish to be found throughout the northern hemisphere. It has a narrow body, 20–45 inches in length, and weighs from 2 to 20 pounds. In America the pike is represented by several fish commonly called "pickerel."

ROACH

A small European fresh water fish. In America the name is applied to various fish which resemble the roach, such as the sunfish, the Lafayette.

SALMON

Justly called the king of fish and ranking foremost among the food fish of this and other countries, found in all the northern climates of America, Europe, and Asia. The salmon attains a length of from 3 to 4 feet and an average weight of from 12 to 30 pounds; also specimens have been known to weigh over 70 pounds. The color of the adult fish is a blackish-blue on the back and the underneath part a glistening silvery white luster. The flesh, when fresh, is of a bright orange color, and is of the best flavor when taken after sea feeding. In fall the salmon ascends the rivers, sometimes as far up as 70 or 100 miles. Here it deposits its spawn in gravel or sand. The spawn lies buried until the middle or end of March, when the young come forth, and for 2 years are gradually increasing in size, until they attain the smolt stage. The young fish are then supposed to leave the river and make their first migration to salt water. The smolts grow rapidly in the ocean and return in about 2 months to fresh water in the form of a grilse, weighing from 3 to 4 pounds. In the grilse stage they are capable of depositing eggs and then return to the sea again. After their third stay in the ocean, they return after 3 months' absence as an adult salmon.

Particular care should be taken that, no matter in what form salmon is cooked, it must always be well done, as, if this fish is eaten insufficiently cooked it is both unwholesome and indigestible.

STURGEON

Commonly termed "royal sturgeon," is a large cartilaginous fish found in northern Europe, especially Russia, in the Black, Caspian, and Medi-

terranean Seas, in the Don, Danube, and other large rivers, and in the lakes of North America. The Pacific coast has a large and important species in the white or Columbia River sturgeon, weighing from 300 to 600 pounds. Sturgeon grow to a very large size, from 10 to 12 feet in length and from 500 to 600 pounds in weight. Those that inhabit the Caspian and Black Seas sometimes attain a length of 20 to 24 feet and a weight of 2,000 pounds.

There are many species of sturgeon, and all pass the greater part of the year in the sea. Like the salmon, they regularly ascend the large rivers in the spring and deposit their spawn. A few species are confined to fresh water. Its flesh is considered very delicious. The commercial value of the sturgeon in Russia alone is enormous, including the isinglass (the air bladder) and the caviar, which is the roe of the sturgeon.

TENCH

A fresh water fish of the carp family, found in standing water all over Europe, and remarkable for its tenacity to life.

TROUT

The brook or speckled trout is easily distinguished by its red round spots, which cover the whole of the fish as far as the belly. It is a very handsome fish. It does not exceed in length more than 12 or 14 inches and in weight more than ½ to ¾ pound. It inhabits clear, running water with a pebbly bottom, swims very fast, and can jump like a salmon, to which family it belongs. The flesh of the trout is of a delicious flavor, and from the time of the Romans it decorated the table of the wealthy. The colder the water from which it comes, the better the flavor. Trout are found in mountain streams all over Europe and America.

The lake trout exceeds all others of the trout family, reaching a weight of over 100 pounds.

C. SALT FISH

ANCHOVIES

Anchovies are put up both in brine and in olive oil.

IN BRINE

Size of container	½ Kg.	1 Kg.	2 Kg.	8 Kg.	12 Kg.
Approximate net weight of fish content	5 oz.	12 oz.	2¼ to 2¾ lbs.	9 lbs.	17 lbs.

IN OLIVE OIL

Size of container	Small can	3-ring bottle	4-ring bottle	6-ring bottle
Approximate net weight of fish content	$2\frac{1}{4}$ oz.	$2\frac{1}{2}$ oz.	$3\frac{1}{4}$ oz.	$5\frac{1}{4}$ oz.

Anchovies in olive oil are packed both plain and rolled in capers.

BLOATERS

Bloater has two meanings:

1. A fat herring, salted and smoked.
2. A kind of cisco, called also the lake herring, very abundant in the Great Lakes of the United States.

COD

Codfish appear in the market as:

1. CODFISH TABLETS

These are strips of boneless codfish, cut 6 inches long, 3 inches wide, and about $1\frac{1}{4}$ inches thick. The tablets are usually made up of 2 or 3 pieces and come in 1-pound boxes, packed 12 to 24 in a case.

2. CODFISH STRIPS

Skinned codfish, usually the whole fish, made up in a roll, varying in weight from 2 to 4 pounds.

3. CODFISH MIDDLES

The thickest and choicest part of the codfish. Packed in 40-pound boxes.

HADDOCK

A cured and smoked haddock is offered in the market as "Finnan Haddie" (See Haddock under Salt Water Fish).

HERRING

A. NORWEGIAN HERRING

2K Herring—small herring, running from 650 to 700 to a 220 barrel (100 Kg.).

4K Herring—large herring, running from 400 to 450 to a 220 barrel (100 Kg.).

B. HOLLAND HERRING

Holland herring are packed in:

100 Kg. barrel
90 Kg. barrel
½ barrel
¼ barrel
Keg (about 5 Kg. or 11 lb.)

SPECIALTIES MADE WITH HERRING

MARINATED HERRING

Herring pickled in vinegar with lemon slices and onions, bay leaves, allspice, black pepper, mustard seeds, cloves (whole), and small Japanese peppers.

ROLL MARINATED HERRING

Marinated herring, split in halves, boned and rolled around a piece of pickle. Fastened together with a toothpick.

KIPPERS

Any fish, also mostly herring, may be called "kippered" when split, cleaned, dried, and rubbed with salt and pepper.

D. SHELL FISH

CLAMS

A name for almost any edible bivalve mollusk other than a scallop, mussel, or oyster.

Two kinds are generally found in the market:

1. The hard or round clam (known as "quahaug"), contained in heavy triangular shells, and
2. The soft clam (also called surf or hen clam), in thin elongated white shells.

COCKLES

A small edible mollusk related to the American quahaug (clam). In Europe much used as food.

CRABS

The blue crab is found from Cape Cod to Florida. The fiddler crab is found in great numbers on the Atlantic coast.

The crab offers a much larger proportion of non-muscular material than the lobster. It has more flavor, is more easily digested, and is cheaper and preferable to the lobster as a food.

CRAYFISH OR CRAWFISH

Closely related to the lobster, inhabiting rivers and ponds.

LOBSTERS

Lobsters were known and eaten by our ancestors 500 years ago. Those of greatest commercial importance are the common lobster of eastern North America and its ally, the European lobster.

It may be that the lobster and crayfish are the least desirable as food, as they so frequently cause indigestion. Nevertheless, they are extremely popular as a luxury and change. Their flesh contains little or no oil, therefore they should be taken with plenty of oil and vinegar, which assists the solid fiber of which they are composed.

MUSSELS

A name given to a number of sea and fresh water mollusks. The common edible mussel is found on the shores of North America and in Europe. They may be obtained nearly all the year round, are very inexpensive, and full of flavor.

OYSTERS

A well-known edible mollusk. There are over 100 known species of oysters. It is the most extensively eaten shellfish and, next to the herring, the most valuable commercially of all food obtained from the sea.

The largest known oyster ground in the world is Chesapeake Bay, with Long Island second. In Europe the "Whitstable Native" and the "Colchesters" are considered the best.

The American oyster cannot be transplanted to European waters.

PRAWNS

A small shellfish of the shrimp family, prized for food.

SCALLOPS

A kind of shellfish with a shell like a comb.

SHRIMPS

A small shellfish allied to the lobster, crayfish, and prawn, found on sandy shores all around North America.

Removing the shells of shrimps and canning them forms an extensive industry.

WINKLES, WHELKS

A large class of mollusks of marine gasteropods like snails, slugs, limpets, etc.

CANNED FISH

BONITO

The bonito resembles the mackerel in appearance and the tuna in flesh, although the color of the flesh is reddish.

The bonito is canned in the same way as the tuna.

CAVIAR

Caviar is the salted roe of the sturgeon. In the United States eggs of fish other than sturgeon are prepared as caviar. The product must, however, be labeled with the name of the fish used.

Grading

Whole Grain Salted.	Very large eggs (similar in size to a large buckshot), containing 8–10% salt. Gray in color.

Other Grades

Caviar Paste, Pressed Caviar, Small Grain.

CRAB

The domestic crab meat is obtained from the blue crab caught along the Virginia coast. Its meat is flaky and of grayish white color. The Japanese crab meat is white and similar to that of the lobster. The meat of the domestic crab is superior in flavor to the Japanese crab meat.

The Japanese Canned Crab Packers' and Exporters' Association prescribes for:

Fancy Crab Meat	Chiefly large leg meat of beautiful appearance and perfect as to container and processing. By rule, in order to grade Fancy, the pack must run 70% leg meat. Most Fancy packs, however, average better than 80% leg meat. In order to grade strictly Fancy, the leg meat must be large.

Choice	Chiefly composed of leg meat somewhat smaller than appropriate for Fancy pack, or a pack in which slight imperfection in technique of packing or processing occurred, which would otherwise grade Fancy.
Fair	Slender pieces of leg meat or a Choice pack in which defects are apparent.
Passed	Flake meat, chiefly composed of body meat with or without slender leg meat.

All crab meat is packed in tin cans, lacquered inside, with a parchment paper lining to prevent the meat from turning black.

Packed in cans	½s Flat	1s Flat
Net weight of contents	6½ oz.	13 oz.

LOBSTER

Lobsters are canned in Maine, Nova Scotia, and on the northeast coast.

Packed in cans: Size of container	¼s Flat	½s Flat	No. 1 Flat
Net weight of meat	3 oz.	6 oz.	12 oz.

GRADES

Fancy (Basis of No. ½ size can.)
Should show the whole claw (3 or 4) carefully sandwiched at top. Meat of claws should be white, retaining its bright red skin. Under the claws should appear the tails (3 or 4), carefully encircled so that the tip of one tail will overlap the butt of another. Tail meat should be white, retaining its bright red skin. Within the circle of the tails should appear the fine arm meat in quantity not much over 1 ounce. The entire package should be practically free from blood (blood appears as white curd adhering to the meat). The strength of the sauce water should not be over 2½% saline, and in quantity about 2 ounces in weight. The out turn of meat

should be 6 ounces exclusive of liquor. The No. 1 Flat Cans and the No. ¼ Flat Cans should contain a proportionate amount of claws, tails, and arm meat, and the out turn of meat for each size should be 12 or 3 ounces, respectively.

OYSTERS

Oysters were first canned in this country in Baltimore and developed a large market for the famous Chesapeake Bay oyster. On account of the large demand for raw oysters, the supply of northern oysters for canning became limited and canning has largely been confined to the south Atlantic and Gulf coasts (Virginia, Carolina, Florida, Georgia). Oysters are packed in cans.

Size of container	4 oz.	5 oz.	6 oz.	8 oz.	10 oz.	12 oz.
Approx. number of oysters per can: Standard	45 or less	60 or less	....	90 or less	120 or less	....
Select	15/20	15/20	25/28	....	....	55 or less
Extra Select	....	....	18/22	....	....	40 or less

GRADES

Extra Selects and Selects — Large, firm oysters, practically uniform as to size, uniform color, liquor should be tasty, bright, and approaching sky blue in color.

Extra Standard — Firm oysters, reasonably uniform as to size. Practically uniform color. Liquor should be bright and tasty.

Standard — Firm oysters, ungraded for size, reasonably uniform color.

SALMON

The Chinook, King, or Spring salmon is the largest of the salmons, and its flesh, when canned, readily separates into very large flakes. It is usually very rich in oil and is commonly sold in several grades, according to the color, which varies from a deep red to white. The large flakes and abundance of oil gives this fish a soft texture, and it is more suitable for salads than for cooked dishes.

The Red, Sockeye, or Blueback usually has a deep red color, a small flake, and a considerable amount of oil. It is firm in texture and is particularly well adapted to salads and to eating as it comes from the can. It may also be used for sandwiches and cooked dishes, but other kinds, costing less, are equally suitable for these purposes.

While the two kinds of salmon already described may mature in four of five years, or even longer, the Medium Red, Coho, or Silver salmon generally does so in three. It is smaller than the King, but larger than the Red. Its flake is large and the color distinctly red, but averaging lighter than the Red salmon. It is an excellent fish suitable for all purposes.

The Pink salmon is the smallest of all the salmons, and is more finely textured than the rest. The flakes are small and range from a light to a deep pink in color. The Pink salmon has a distinctive delicate flavor and is particularly well adapted to sandwiches, chowders, and various cooked dishes. Over half of the entire American pack consists of this species, and its abundance brings the price very low.

The Chun, or Keta salmon, while highly esteemed by the fishermen as fresh fish and by the Indians for drying, becomes, when canned, the cheapest of them all. It is a rather large and somewhat coarsely textured fish with little color; however, it can form the basis for many nourishing and palatable cooked dishes, bringing the healthful qualities of the sea to homes that cannot afford the other kinds costing more.

Salmon comes packed in cans.

Size of container	½s Flat	No. 1 Flat	No. 1 Tall
Net weight of contents	8 oz.	16 oz.	16 oz.

Canned salmon should be labeled with the name of the species of fish contained in the can (U. S. Food Insp. Decision No. 105).

The can should show about ¼ inch head space, not more than 2 or 3 pieces of fish in the can. The long axes of the pieces should parallel the long axis of the can. Ends of pieces should be clean cut, not jagged, free from skin on the end of the cylinder of fish. Free from pieces of gills, fins, and intestines. Free from all clotted blood that can be washed out without tearing the fish. Blood sometimes settles behind the backbone or a fish is bruised before the blood has congealed. These blood clots cannot be removed and their presence does not signify poor cleaning. Ribs should be loose, flesh should not be torn, vertebrae should break

easily between the fingers. Ribs should be brittle, breaking without much bending. In the majority of cases an 8-inch or more vacuum is satisfactory. (Determined with a compound vacuum pressure gauge equipped with a hollow piercing point and a rubber gasket.)

SARDINES

According to a definition by the Bureau of Fisheries, U. S. Department of Commerce, any small fish of the herring family, properly prepared, are entitled to be called sardines.

In Europe the pilchard, sprat, and bristling are canned as sardines.

In Maine the young herring and in California the Pacific sardine, a species of the pilchard.

DOMESTIC SARDINES

Size of container	¼s square	½s square	½s oval	No. 1 oval
Net weight of contents	3¼ oz.	7½ oz.	7½ oz.	15 oz.
Style of packing	Olive Oil Cottonseed Oil	Olive Oil	Tomato Sauce Mustard Sauce	Tomato Sauce Mustard Sauce (pickled)

IMPORTED SARDINES

NORWEGIAN

Size of container	⅙s	⅛s	¼s	⅛s	¼s	¼s high	½s
Appr. net weight of contents	1½ oz.	2½ oz.	3¾ oz.	2¼ oz.	4 oz.	5 oz.	8 oz.

GRADES

Bristling .... 22/24—18/20 fish per can
Mussq or Sild .... 16/18—12/14—8/10 per can

FRENCH

Size of container	⅛ club	¼s	¼s high	½s
Appr. net weight of contents	3½ oz.	4¼ oz.	6¾ oz.	8 oz.

GRADES

The French and Portuguese packers offer sardines under the self-explanatory grades of:

Small Count, High Count, Boneless (with tails), Boneless and Skinless (without tails).

REQUIREMENTS FOR ALL VARIETIES

Fish should be of uniform size, firm but tender. Vertebrae should crush easily when pressed between thumb and finger. Can should show a liberal quantity of oil or sauce.

SHRIMPS

The canning of shrimps is carried on in the South Atlantic and Gulf States, where two styles of pack are put up, the "wet pack" and the "dry pack."

For wet pack shrimp some brine is added, and the label should show the drained weight. They are packed in cans and in glass.

Size of container	No. 1 Tin	No. $1\frac{1}{2}$ Tin	$5\frac{1}{4}$ oz. Tumbler	$6\frac{1}{2}$ oz. Tumbler
Net weight, dry pack	5 oz.	$8\frac{1}{4}$ oz.	....	....
Net weight, wet pack	$5\frac{3}{4}$ oz.	$9\frac{3}{4}$ oz.	$5\frac{1}{4}$ oz.	$6\frac{1}{2}$ oz.

TUNA AND TONNO

There are four varieties of canned tuna:

1. The Albacore Tuna or Long Fin Tuna—meat white.
2. The Yellow Fin Tuna—meat slightly pink.
3. The Blue Fin Tuna—meat pink.
4. The Striped Tuna or Skipjack—meat brown.

They are packed in cans.

TUNA

Size of container	$\frac{1}{4}$s Flat	$\frac{1}{2}$s Flat	No. 1 Flat
Net weight of contents	4 oz.	7 oz.	13 oz.
Net weight drained	$3\frac{1}{2}$ oz.	$5\frac{3}{4}$ oz.	$11\frac{1}{2}$ oz.

TONNO

Size of container	¼s Flat	½s Flat
Net weight of contents	3½–4 oz.	7 oz.
Net weight drained	3–3½ oz.	5 oz.

The net drained weights shown above for tuna (not tonno) are those prescribed by the U. S. D. A. Bur. Chem. Circular, April 29, 1925.

GRADES

Standard White Meat — Packed from albacore (long fin tuna), perfectly processed, not less than 80% steak, meat white. No discolored meat, perfectly cleaned, a quantity of oil sufficient to thoroughly season the meat (approximately 1 ounce to a No. ½ can at time of filling).

Yellow Fin — Packed from yellow fin tuna, perfectly pressed, not less than 80% steak, meat slightly off to pink from white, no discolored meat, perfectly cleaned, a quantity of oil sufficient to thoroughly season the meat. (approximately 1 ounce to a No. ½ can at time of filling).

Blue Fin — Packed from blue fin (leaping tuna), perfectly pressed, meat practically the same as yellow fin, slightly darker, well cleaned, not less than 80% steak, no discolored meat, a quantity of oil sufficient to thoroughly season the meat (approximately 1 ounce to a No. ½ can at time of filling).

Striped — Packed from striped tuna (skip jack), perfectly processed. This is the darkest meat of the four grades of tuna, having a decidedly brownish-pink cast. Not less than 80% steak, well cleaned, practically free from discolored meat, a quantity of oil sufficient to thoroughly season the meat (approximately 1 ounce to a No. ½ can at time of filling).

White Meat Flakes or Pieces — Packed from the small pieces or flakes that are accumulated when cutting fish for the standard white meat pack. No mixed varieties, good

	color, reasonably free from discolored meat. Also the same amount of oil is used in preparing this pack as in the regular pack; the can, when cut, will not show any considerable quantity of "free oil" as the flaked condition of the meat promotes greater absorption than in the "steak" pack.
Light Meat Pieces or Flakes	Packed from the small pieces or flakes that are accumulated when cutting the regular packs of yellow fin, blue fin, and striped tuna; may contain these three varieties singly or mixed, free from badly discolored meat, also the same amount of oil is used in preparing this pack as is used in the regular pack; the can, when cut, will not show any considerable quantity of "free oil" as the flaked condition of the meat promotes greater absorption than in the "steak" pack.

Albacore (long fin tuna) is the only variety that may be labeled white. The three other varieties may be labeled light meat or California tuna.

All labels must bear the legend "packed in cottonseed oil" or an equivalent phrase, such as "in salad oil made from cottonseed" when this variety of oil is used.

TONNO

Italian style in olive oil.

Packed in Kanopen cans, may be either lithographed tins or labeled.

Packed from yellow fin or blue fin or striped tuna, but no mixed varieties, all steak, no flakes, perfectly pressed, meat brownish-pink, well cleaned, no discolored meat, liberal quantity of olive oil (about 2 ounces to a No. ½ can when packed).

SMOKED FISH

It is hardly possible to furnish directions for smoking all species of fish, under all the varying weather conditions that will be encountered with the changing seasons. Only the general methods can be given here, as used on a typical variety under average conditions. This is intended as a guide, not an infallible recipe. To smoke fish successfully, experiment and use intelligence—altering the method according to the preference of

markets (amount of salt and smoke flavor), the variety of fish, and weather conditions.

There are two general methods of smoking fish—hot smoking or "barbecuing," and cold smoking.

Any fish may be "hot-smoked" or "barbecued" but the following varieties are some of those to be preferred:

Butterfish	Sailfish
Kingfish	Spanish mackerel
Mullet	Shad
Grouper	

Sturgeon is always hot smoked.

Because of the keeping qualities of cold-smoked fish, certain varieties offer market possibilities for quantity production, such as:

Alewife or river heering	Grouper
Shad	Kingfish
Drum	Robalo or snook
Mullet	Squeteague (spotted trout)
Red snapper	Spots
Redfish	

In the first method the fish are laid three or four feet above a fire, and cured at temperatures from 150° to 200° F. The fish are wholly or partially cooked by this method, and therefore, no matter how carefully prepared, or how long smoked, will "keep" for periods of from a few days to a couple of weeks. If fish is to be preserved for any period of time, the cold smoking method should be used. In this process the fish are cured over a low smouldering fire at a temperature of 90° F., or less. The efficiency of the process depends on the drying action of the fire, which must be carried on at a temperature that will not cook the flesh. Fish may be given a short cold smoke, if preservation is intended for a few days only, or cured for several days if it is wished to "keep" them for some time. This product is comparable to ham or bacon and should be cooked before using. The same general principles governing smoking, handling, and storing of cured meats should be followed in smoking fish.

A smokehouse for curing small lots of fish may readily be made, following instructions given here. Obtain a box or make one, about 6 by 3 by 3 feet. One end, that resting on the ground, should be removed. About 12 inches above this end a false bottom with auger holes at 2-inch intervals is built. This end of the box is set over a pit 2 feet wide by 18 inches deep.

A trench about 1 foot wide by 1 foot deep is dug from this pit for a dis-

tance of about 10 feet. The fire pit, a hole 3 feet wide by 3 feet long by 18 inches deep, is dug at the end of this trench, which is then covered by sheets of galvanized iron, forming a chimney for the smoke from the fire pit to the smokehouse. If it is desired to build a more permanent house, terra cotta drain or sewer pipe may be used to connect the fire pot with the smokehouse. Cleats are nailed inside the box on the sides, the first set about 12–14 inches below the top. The trays for holding the fish, or the ends of the smoke sticks, rest on these cleats. A few holes should be bored for ventilation in or near the top of the house.

If mullet or Spanish mackerel are to be smoked, the following process is recommended:

The fish should be split along the back just above the backbone, almost to the tail, so that it will lay flat in one piece, leaving the belly portion solid. Clear out all traces of intestines, black skin, and blood, taking special care to remove the coagulated blood and kidney just under the backbone. The head may or may not be removed, depending on the individual. If the head is cut off, the hard bony plate just below the gills should be allowed to remain, as it will be needed to carry the weight when the fish are hung on rods. If it is cut off the fish often pull loose and drop from the sticks.

After splitting and cleaning, the fish should be dropped in a brine made by adding two cups of salt to 4 gallons of water. They are left in this brine 30 minutes to soak out blood diffused through the flesh. At the end of this time they should be taken out, rinsed, and freed from any remaining traces of blood or other offal. Drain for a few minutes, then drop each fish singly in a shallow box of fine salt, "dredging" it about, then picking it up with as much salt as will cling to it, and packing the fish in even layers in a tub or box.

The fish should be left in salt from 1 to 3 hours, depending on weather, size of fish, fatness, and length of time for which preservation is desired. The exact length of time must be determined by the smoker. When the fish are taken out of salt they should be rinsed in brine, scrubbing off all visible particles of salt or dirt. The fish should then be laid on chicken wire drying racks kept out of the direct rays of the sun, but located where a good breeze can reach them. Wire drying racks are desirable as the fish can dry on both sides. One side will remain wet, if laid on boards. The fish should be given about 3 hours' drying, until a thin film is formed on the surface, before putting the fish in the smokehouse. If put in immediately after taking out of salt, the fish will be too moist, will require longer smoking, will not color and dry as well, and will not have as good a surface.

The fish may be placed in the smokehouse on wire mesh trays, or hung

on sticks or iron rods. In no case should any two fish touch, as this will prevent the drying and penetrative action of the smoke. If hung on rods, more fish may be smoked at one time, and they will smoke better, with a clearer color. Trays, of course, give less trouble. Rods are run through the fish just under the hard bony plate at the neck, one rod on each side. Thus, each fish hangs from two rods. Twelve or fourteen fish may be hung on a set of two rods 3 feet long.

The fire should be started an hour or two before the fish are put in the house. It should be low and smoldering. Almost any hardwood or wood other than pine may be used for fuel. Pine or other pitchy woods will give the fish a bitter taste. Some of the woods that may be used in the Southern States are scrub oak, live oak, hickory, sweet bay, river mangrove, palmetto roots, button wood, and coconut husks. In smoking any one kind of fish, such as mullet, variety of flavor may be obtained through the choice of wood used in smoking. In addition to the woods listed above, orange wood gives a particularly pleasing flavor. Cypress may also be used. The fire should not give off too much smoke during the first 8–12 hours. A dense cloud of smoke should be built up for the balance of the process. The fire must be small and steady. Two short chunks of wood—about 2 feet in length and the thickness of a man's arm—are usually sufficient. The fire pit is kept covered with a sheet of metal to drive as much smoke as possible up into the smokehouse, and to keep the fire from burning rapidly. The fire must not be allowed to blaze up. The air should not feel warm on the hand if it is put in the smokehouse. The fish should be smoked for 24 hours, if they are to be kept for a couple of weeks, and for 4 or 5 days if it is wished to keep them for some time. The fire should not be allowed to die out at night or to be built up too large the last thing at night to make it last until morning.

After taking the fish out of the smokehouse dry for an hour or two in the air, then wrap in sheets of waxed paper, sprinkling a little fine table salt on each one, and store in tin or wooden boxes. Keep in a cool, dry place. If signs of mold appear, sponge off with vinegar and give the fish a short smoking for from 3 to 6 hours.

HOT SMOKING—GERMAN METHOD

The following method is recommended if it is desired to prepare a hot smoked fish that can be used immediately without cooking. It will keep without molding or souring longer than other hot smoked fish.

Split, clean, and soak the fish to remove blood as instructed previously. Then prepare a brine as follows: 2 pounds of salt, 1 pound of sugar, ½ ounce of saltpeter, 1 ounce of crushed whole black peppers, 1 ounce of crushed cardamom seeds. Make this up into a 90° brine, that is, one that

will float a potato with a 10-penny nail stuck in it. Increase the amount of ingredients according to the quantity of brine you wish to make. The number of spices used can be increased in variety and amount. Various spice mixtures are used.

Put the fish in this brine for a period varying from 2 to 4 hours, depending on the size and thickness of the fish, amount of fat, and the taste of the individual. Some require a less salty taste than others. The exact length of time must be determined by experiment. Rinse off the fish in fresh water, and place on drying racks outside in a cool, shady, breezy place to dry for about 3 hours before putting in the smokehouse.

For the first 8 hours that the fish are in the house, give them a cool smoke in a dense cloud of smoke. Then increase the fire until the temperature is between 130° and 150° F. for 2 or 3 hours, or until the fish have a glossy brown surface. This partially cooks or "hot smokes" the fish. Wipe any moisture off the fish, and cool for a couple of hours before storing. Wrap in waxed paper and store in a cool dry place. Do not allow them to come into contact with ice, or store in wet cold.

In some cases the fish are brushed over lightly with vegetable oil (usually cottonseed) either just after finishing the cold smoking part of the process, or on taking out to cool. Another method of handling this fish after smoking is to cut the flesh up into fingers the length of a No. 2 can or pint glass jar. Skin and pack into the can or jar. Then add vegetable oil (cottonseed or olive oil, if you have it) until the spaces between the pieces of fish are filled and there is a layer of oil up to within an eighth of an inch of the top. Seal the cans or jars and store in a cool place such as an ice box until used. Under such conditions it should keep almost indefinitely. As this product is not "sterilized" the cans or jars should be thoroughly scalded before use. In some cases the oil is filled in hot and the containers sealed immediately.

SMOKING FISH

LAKE HERRING AND WHITEFISH

The process of smoking lake herring and whitefish is identical. If the fish are frozen when received at the smokehouse, they are thawed in the open air, or better, by immersing and stirring them in a barrel of water of medium temperature. After thawing they are split down the belly to the vent, eviscerated, washed thoroughly, and pickled in butts or barrels, about 4 pounds of fine salt to 100 pounds of fish being scattered among them and sufficient brine of 90° salinity to cover them. Either dry salt or brine alone may be used, the former being preferred in warm weather and the latter during the winter. In case brine alone is used, some dry

salt should be placed on top to strengthen the weak pickle floating at the surface. After remaining in the pickle for 10 to 16 hours, according to the strength of the pickle and the flavor desired, the fish are removed and strung on the smoke rods, 10 to 20 fish to each rod, according to its length and the size of the fish.

In stringing, some curers pass the rod through the body immediately below the nape bone, effectively preventing the fish from falling down in smoking, but also marring its appearance somewhat. A more usual way is to pass the stick in at the right gill-opening and out at the mouth. Others pass the rod through the head near or through the eyes, and a few pass it immediately back of the throat cartilage. The latter leaves a neat appearance, yet it permits more fish to fall in the smoking process than when the rod is passed through the head or the shoulders. In some houses the smoke-stick is not passed through the fish, but instead a stiff iron wire, curved in "S" shape, is used to attach the fish to the stick, one end of the wire passing through the fish at the head or beneath the nape bone and the other hung over the smoke-stick. At Grand Haven, and to some extent in Chicago, Milwaukee, and one or two other places, the fish are secured by having stout smoke-sticks, about 1½ inches thick and 2½ inches wide; in the top of each, and about ¼ inch from the edge, is driven a row of tacks or small wire nails at intervals of about 3 inches, projecting about ½ inch above the surface. Ordinary cotton wrapping cord is tied to the wire nail at the end of each stick, and by means of this cord passing around each nail a single herring is held in place between each two nails throughout the length of the stick, the fish being placed with the back of the neck against the stick and the cord passing from one nail around the throat of the fish, entering under the gills on each side, and then around the next nail, and so on to the end. By having the stick of sufficient width, a row of small nails may be placed on each edge, so as to attach a row of fish at each side. This removes nearly all risk of the fish falling, and their appearance is not marred by holes through which the smoke-stick has been passed.

Some markets prefer the herring well smoked on the inside, and to accomplish this the sides of the abdominal cavity are stretched open by means of small wooden sticks or toothpicks, either one or two sticks to each fish. This permits the smoke to permeate the stomach cavity better and results in a more durable article. In general, the western trade prefers the stomach cavities stretched open, while the eastern markets prefer them without the sticks; but there are exceptions. The smoked lake herring sold in Washington are mostly extended by means of a small stick, or, in case of large fish, by two small sticks.

The fish attached to the sticks are dipped in fresh water to remove

surplus or undissolved salt, loose scales, etc., (unless they have been rinsed before stringing) drained, and suspended in the smokehouse 4 to 8 feet above the floor, and subjected to a gentle smoke for 4 or 5 hours. The door or damper is then closed, the fires spread or built up, and the fish cooked for 1 or 2 hours according to the amount of fire, the height of the fish, and the particular cure desired. After cooling, which is accomplished either by opening the doors of the smokehouse or by removing the fish to the outside, they are ready for the trade. One hundred pounds of round fish, or 85 pounds of dressed, yield about 65 pounds of smoked. Ordinarily these fish keep 1 or 2 weeks, and even longer.

LAKE TROUT AND CARP

Smoked lake trout and carp are prepared to a small extent in the manner already described for lake herring or whitefish.

ALEWIVES, OR RIVER HERRING

River herring or alewives are smoked in a number of localities, but principally in Maryland and Virginia.

In preparing these fish in the Chesapeake region they are washed in vats and scaled with a knife as soon as practicable after removal from the water. They are next immersed overnight in strong brine, containing 12 to 14 pounds of Liverpool salt to each 100 pounds of fish, with some dry salt on top to strengthen the weak pickle that rises to the surface. The following morning the round fish are strung on smoke-sticks, the stick being usually entered at the left gill-opening of each fish and out at the mouth, as in case of hard herring or bloaters on the New England coast. The strings of fish attached to the stick are then dipped in fresh water to rinse them off, and after draining and drying for a few hours are suspended in the smokehouse about 6 or 8 feet above the fire, and exposed to a dense but cool smoke made of pine shavings or similar material for about 2 or 3 days. Care must be taken to prevent the fire from becoming too hot, thus causing the fish to crack at the lower end or possibly to fall from the sticks to the floor. Prepared in this manner the river herring will usually keep in good condition in the Chesapeake region for 30 days during the spring and for a somewhat less period in the summer. As the fish are not eviscerated before smoking the decrease in weight is small, 100 pounds of round fish yielding about 85 pounds of smoked. The wholesale price is about 20 to 22 cents per dozen, according to the size and condition.

In Washington, Baltimore, and one or two other places the river herring are prepared in the following manner:

The fresh herring are scaled with a knife, gibbed like the pickled her-

ring of Scotland, washed, and pickled for 3 hours in brine, about 20 pounds of Liverpool salt being used for each 100 pounds of fish. On removal from the pickle they are strung on small iron rods, the rod passing through the eye sockets of the fish, drained for an hour or so, and hung in the hogshead smokehouses, in the bottom of which a fire has been made of equal quantities of oak and hickory wood. The fish are dried for a few minutes and then the tops of the hogsheads are covered with old sacks or other suitable material. From time to time the fire is sprinkled with water to produce a vapor and the fish thus exposed to heat, smoke, and steam for about 3 hours, when they are removed and cooled and are then in condition to be eaten. Only oak and hickory should be used as fuel, as other materials do not produce the proper flavor. If the fire becomes too warm it should be smothered with oak or hickory sawdust.

The process of smoking alewives commonly employed in the New England States differs from the Chesapeake process in a few minor particulars. The smokers are usually not so careful about removing the scales with a knife, depending generally on the frequent handling of the fish to scale them if cured soon after removal from the water. It is also customary in salting the fish to permit them to make their own pickle, the fish remaining in the pickle for 3 to 5 days. On removal they are soaked in fresh water for 5 to 6 hours and strung on hardwood sticks, the stick entering through the left gill-opening and out at the mouth. They are next rinsed, drained and dried for a short while and suspended in the smokehouse, where they are exposed to a smoldering fire of hardwood and sawdust for 3 to 4 days, when, after cooling, they are ready for sale.

SHAD

In the Chesapeake region and at various points along the coast small quantities of shad are smoked, usually in precisely the same manner as already described for river herring or alewives.

CATFISH

Being intended as a substitute, the catfish are smoked in identically the same manner as are sturgeon. The fish as received at the smokehouse are usually beheaded and eviscerated. They are skinned and cut into small pieces, weighing about 1 or 1½ pounds each, and are pickled for 6 or 8 hours in tight barrels. This may be accomplished by rubbing the pieces with salt and placing them in the barrel either with dry salt scattered among them, or simply by placing them in the barrel with dry salt or with strong brine. On removal from the brine the pieces are rinsed by dipping in fresh water, to remove slime, surplus salt, etc.; they are then attached to the smoke-sticks and drained for an hour or so, and placed in the

smokehouse, where they are smoked for 7 or 8 hours in the same manner as sturgeon are treated. One hundred pounds of dressed catfish yield from 65 to 70 pounds of smoked, and the product sells usually at about 15 or 16 cents per pound. The total annual product of smoked catfish in the United States does not exceed 50,000 pounds, and its sale is confined principally to those who are willing to accept a substitute because of its being cheaper.

At several points in the Mississippi Valley the small catfish are smoked whole, like lake herring. They are split to the vent and eviscerated, the head and in some instances the skin being left on, struck with salt in tight barrels, and smoked for a few hours in the manner described for lake herring.

EELS

Generally the eels are received at the smokehouse fresh, directly from the fisheries, but some are also received frozen from cold storage. In the latter case they are thawed by immersing them in water a few hours or by exposure to the open air. Some smokers "slime" the eels with salt; that is, rub the skin with a small quantity of fine salt to remove the slime therefrom. In dressing, the fish are split from the head to the vent and the viscera removed. It is desirable to continue the splitting down to the end of the tail sufficiently deep to remove the large vein along the backbone, but sometimes this may be pulled out without splitting the fish more than an inch or two beyond the vent. Few smokers, however, give attention to this item. The eels are immersed in strong brine from 1¾ to 7½ hours, according to strength of brine, size of fish, and the desired flavor. This brine should be quite strong, about 20 pounds of Liverpool or other good salt being required for each 100 pounds of fish.

In New York the eels are usually pickled for 2 hours, while on the Great Lakes the length of time is generally about 7 hours. On removal of the fish they are washed, bristle brushes being used by some smokers, while others simply dip the fish in water for removing the slime and surplus salt. A few smokers throw them in a tub of water and beat them with a net for several minutes to accomplish the same purpose. The eels are next strung on iron or steel rods ⅓ inch in diameter, the rod passing through the head of each eel, or through the throat cartilage and out the mouth, and hung in the open air for a few hours for drying. But if the atmosphere be moist or the saving of time necessary they may at once be placed in the smokehouse.

In New York, where small brick ovens are used, the fish are subjected to a mild smoke for about 4 or 5 hours until they have acquired the proper color, when the fires are gradually increased and they are hot

smoked or cooked for 30 or 40 minutes. At Buffalo and some of the other Great Lakes ports, the smoking is usually at an even temperature throughout and continues for 6 or 8 hours. Mahogany or cedar sawdust is used in New York for making the smoke, while hickory or white oak wood is used for cooking, the latter being preferred. In Washington the eels are suspended in the hogshead smokehouses over a fire made of oak and hickory wood and dried for 20 minutes, when the hogshead is covered with sacking and thus hot smoked for 3 or 4 hours, the fires being sprinkled with water from time to time to produce a hot vapor. The smoking must be carefully attended, for if the heat becomes too great the fish will curl up out of shape. A good test to determine whether the cooking is sufficient is the ease with which the skin may be separated or peeled from the flesh when the eel has been split.

The decrease in weight by dressing and smoking is about 35%, 100 pounds of eels yielding 65 to 75 pounds of smoked. When eels have been pickled 6 or 8 hours they ordinarily keep 10 or 12 days; but when the salting has been only 2 hours, as is usual at New York, they are liable to mold after 5 or 6 days. Smoked eels keep a shorter length of time than almost any other smoked fish.

Eels are sometimes skinned before being smoked, the process being the same as described above, except that less salting and smoking is required, and it is also very difficult to keep them from falling down off the rods in the smokehouse.

SALTING (INCLUDING CORNING) RIVER HERRING

The fish are usually taken from the boats on the day they are caught, but in some cases not until the third or fourth day. All handling of the fish is with scoop nets. When taken from the boats, they are spread upon the wharf for cutting. Sitting on a low inclined seat with his knees on the wharf, the cutter removes the head and belly and scrapes out the roe and viscera, the cut fish being placed in a basket and the roe in a bucket. The fish are then dumped into the washing vats. These are 12 feet long by 6 feet wide by 3 feet deep of 2-inch pine. In some the bottom is inclined about 30° to one side, with a horizontal false bottom of slats above the incline. Scales, dirt, and other washings settle down in the deep angle of the bottom and are drawn off with the wash water through two flood gates without loss of time. Others still employ flat-bottomed vats with resultant loss of time in cleaning.

The fish are agitated in the vats (which are kept filled with water) for about 10 minutes to thoroughly wash them and then scooped out with dip nets into slat cars holding about 1200 fish, in which the fish drain as they

are transported to the salting vats. The latter are 10 feet long by 6 feet wide and 24 to 30 inches deep, built of 2-inch Virginia pine. The salting vats contain saturated brine to a depth of 4 inches. As each car of fish is dumped into the brine, additional salt is added, the amount depending upon conditions of temperature of fish, etc., with which the skilled packer is fully conversant. When full, the vats contain from 12,000 to 15,000 fish (about 4000 pounds). The fish should be roused once each day while striking. After each rousing, the fish are tamped down lightly and top dressed with a thin layer of salt.

CORNING

Early in the season most of the packers in the lower Potomac corn their herring for immediate consumption. This method is usually followed for about 6 to 10 days from April 1. The earliest caught fish are kept in the brine from 12 to 48 hours, according to temperature. Fish brined 12 hours when the temperature is from 40° to 50° F. should keep for 10 days. After brining, the fish are taken from the vats and spread on the floor, covered with salt, and the salt and fish thoroughly mixed, after which they are packed in sugar barrels and immediately shipped to the trade. No fish are corned after the temperature rises above 60° F.

HARD CURE OR TIGHT PACK

Herring intended for storage are kept in the brine for 7 to 10 days, according to temperature. At temperatures from 50° to 60° F. 9 to 10 days is sufficient; if from 60° to 70° F., 7 to 9 days will cure them satisfactorily. After the fish are cured, they are taken from the brine and piled on the draining floor to a depth of from 1 to 4 feet, according to available space, and allowed to remain there from 4 to 10 days, according to the demand for the space. The fish are then weighed or counted (weighing is most accurate) and packed in the barrels, the first layer backs down, the balance backs up, with from 2 to 2½ pounds of salt to the layer. A properly packed barrel should contain 160 pounds of fish and 40 pounds of salt.

SALTED FISH

Considerable trouble has been experienced in salting fish in warm climates. The methods followed commercially in other regions have not produced a product of good quality, and the directions given generally for salting small quantities, or for the home curing of fish, have not always proved satisfactory.

If attempts are made to preserve fish by "pickling" or curing in brine, in a warm climate, the product will either turn "rusty" and sour, spoiling

in a short time, or if the quality is good at first the fish soon deteriorates. The best method for curing fish in this region is "dry salting." That is, a combination of salting and drying. If the fish are handled carefully, and directions given below followed closely, a high-quality product that will not spoil nearly as rapidly as salted fish now prepared, can be produced. But if instructions are not followed, it is useless to expect much.

In the first place, the fish must be absolutely fresh. Do not try to save a fish that may be stale, by salting. The fish should be bled, when caught, to drain out all blood possible. Blood decomposes much more easily and quickly than flesh. Fish will keep longer if blood is not diffused through the flesh. They should be thoroughly cleaned as soon as possible. Fish should not be handled roughly in taking out of the net or while in the boat. If fish are piled in heaps, walked on, or forked roughly, they will be of inferior quality and spoil much more readily than they would otherwise. Fish should not be left under the direct rays of the sun in an open boat. A tarpaulin should be rigged above the fish.

Mullet and Spanish mackerel are among the best fish for dry salting, for many reasons, a few of which are: they are split more easily, the loss of weight is less in splitting and cleaning; they are two of the commonest southern fish, and obtained more easily and cheaply. Using this outline as a guide, however, many other varieties of fish, such as grouper, sheepshead, alewives or river herring, spot, croaker, and drum, may be cured successfully, with the resultant product of good quality.

Most fish should be split along the back, just above the backbone, taking care to leave no flesh on it. The fish are split "mackerel style." That is, they must lay flat in a single piece, leaving in the backbone. When the knife is drawn toward the tail it must not go clear through the skin, so that the fish will be in two pieces near the tail. The head may or may not be removed. In splitting Spanish mackerel and other fat fish the backbone is cut out nearly to the tail, where it is broken off. In cleaning, remove all traces of blood from under the backbone and clear away all the black skin. A wire brush should be used for the blood. "Black skin" is best wiped out by a piece of canvas or gunny sack. If the head is left on, clean out all traces of gills. All cleaning must be done thoroughly and carefully.

When the mullet or mackerel are cleaned they should be rinsed, then dropped in a tub of light salt brine (2 pounds of salt to 5 gallons of water), the fish should be left here to soak 30 minutes. The principal object of brining is to remove traces of blood from the cut flesh. It also "cuts" slime and is better for washing than water. Never use sea water from around a fish house, dock, or near shore. It is invariably contaminated and increases likelihood of spoilage.

Score with a knife under the backbone and then longitudinally through the fish on the other side. After the fish have soaked 30 minutes take them out, making sure that each one is properly cleaned. Drain them for 15 minutes. If salted at once the excess moisture will require more salt.

Use a "dairy fine" ground mined salt. Ordinary sea salt is more apt to cause reddening. Coarse salt is not as good as fine salt. Pour the salt into a shallow box about 2 feet square. Dredge each fish in this salt, rolling it about two or three times and rubbing salt into the slashes. Pick it up with as much salt as will stick to it. Scatter a thin layer of salt on the bottom of the tub or box used for salting. Then lay in the fish in an even layer, flesh side up. Be sure that no two pieces of fish touch without salt between. Scatter a little salt on top. Continue this until all the fish are in salt. Each layer should be laid in at right angles to the preceding layer. The top layer should be weighted down, to keep the fish under the surface of any brine formed. The top layer should also be packed skin side up. Use about 1 part of salt to 3 of fish.

The salting shed should be light, open, airy, and cool as possible. The mullet will have absorbed enough salt for curing purposes in about 36 hours. Mackerel should be in salt about 48 hours. At the end of this time take the fish out of the salt and scrub them in a brine of the same strength as used in cleaning to remove all excess salt and dirt. No traces of salt should be visible on the surface. After draining 15 to 20 minutes, the fish are ready for the drying racks. These are frames of wood, covered with chicken wire and standing on legs 3 or 4 feet high.

The drying racks must be placed on dry ground, preferably covered with gravel. Oxidation or rusting sets in immediately if drying is carried on under the direct rays of the sun. But if fish are kept shaded in a breezy location they will dry well with a clear color. For this reason drying is best done in the shade under a roof without walls, so located that as much of a current of air as possible will pass over the fish. The fish are laid out skin side down but are turned three or four times the first day.

The fish are gathered up and placed under shelter at night to prevent spoilage through dampness. If left spread out in the open at night, they will sour and mold. The time required for drying depends on weather conditions during the drying period, and on the size of the fish being cured. The exact time must be determined by the person curing the fish. For mullet it should average about 4 days; Spanish mackerel, 5 days. The more the fish are dried, the less danger there will be of reddening or rusting. When the surface looks dry and hard, and if the thumb can be pressed into the thick part of the flesh leaving no impression, the flesh can be considered as cured.

In weather where air drying is impossible, or in climates too humid for this process, the following method may be used. When the fish are "struck through" or have absorbed enough salt for curing purposes, they should be taken out of salt, scrubbed off in brine, then piled in stacks, flesh side down. These stacks should be heavily weighted down in order to press moisture out of the fish. After 10 to 18 hours in the stack the fish should be repacked in dry salt with the top weighted down, and put in storage in a cool dry place.

Store the fish in wooden boxes lined with waxed paper. Scatter a little dry salt between each layer of fish—about 1 pound of salt to 10 pounds of fish. Store in as cool and dry a place as possible. If signs of rust or mold appear, scrub the fish off in brine and dry in the air for a day or two.

Reddening of salted fish is a form of bacterial spoilage caused by the salt used in curing. Contrary to popular belief, salt is not strictly an antiseptic, and certain types of bacteria live and thrive in a salt medium. Salt most apt to be contaminated is that obtained by evaporation of sea water. Several types of salt used extensively in fish curing are apt to be thus contaminated. In salting fish every effort should be made to use a salt as pure and high in grade as possible. It is advisable to heat salt and bake it thoroughly before using. If, however, reddening appears at any time, all tables and other equipment used in salting should be thoroughly disinfected. Unless every effort is made to keep the salting equipment clean, the use of sterilized salt or other precautions will be useless, as the fish can be contaminated through unclean equipment. After curing, the fish should be stored in the coolest place possible, as the salt reddening bacteria grows best at a warm temperature. At first signs of reddening the fish should be removed, washed thoroughly in pure salt brine, and given a few hours' careful drying and repacked with a thin layer of dry salt between each layer of fish, using from 10 to 15 pounds of salt to 100 pounds of fish. Reddening is most apt to appear in fish stored in pickle (brine) and held in a warm place. It will remain in good condition longer if packed in dry salt and held in as cool a storeroom as possible.

CANNING ALEWIVES OR RIVER HERRING; ROE AND BUCKROE

The following method of canning alewives has proved quite satisfactory. The fish are cut, washed, and placed in the salting vats in the same manner as if intended for salt curing. After 12 to 14 hours they are removed from the vats and washed in an abundance of lukewarm fresh water. During the washing they are trimmed, the balance of the fins and

scales being removed. They are then cut to can size and placed in the cans, after which they are processed for 55 minutes at 244° F. for No. 1 cans and 60 minutes for No. 2 cans.

Herring roe intended for canning is collected in buckets as the fish are cut and washed in fresh water in special trays, blood and adhering particles of entrails being removed. The roe is then put in the cans. As it swells considerably in processing, the cans must not be entirely filled. If of the sanitary type, the cans are filled to within about ¾ inch of the top with roe and then filled to the edge with cold salt brine, about 1 pound of salt to 8 or 10 gallons of water being used to make the brine. The brine is added solely for seasoning. The cans are immediately capped and placed in the processing baskets. If solder-top cans are used, the filled cans are placed in the exhaust box. Upon removal from the exhaust, the necessary air space is provided for by pressing the roe down with a plunger. Material clinging to the groove where the solder is to be applied is removed with a brush and the cans are capped and tipped. The canned roe is processed in a closed kettle for 45 to 55 minutes at a temperature of 240°–245° F. The milt roe may be canned in the same manner as the roe except that the cans can be more completely filled, as this product does not swell in the processing. As the quantity of brine used in this case will be somewhat less, it should be made correspondingly stronger.

Note: In canning the fish, they should be drained of superfluous water before they are placed in the cans, and no water added to can contents. That the fish may retain their shape in the can and stand transportation, the cans should be well filled. The shrinkage of the fish in processing must be taken account of in filling the cans.

CANNING CLAMS (ALASKA)

The first operation is the removal of the clams from the shells. This is done by immersing them in boiling water, either in vats especially designed to receive the wire baskets in which the clams are placed or the clams are passed through the water on an endless belt. After remaining in the water several minutes they are thrown on a table and the shells fall away from the meat. The clams are then passed on to women workers, who open the stomachs and necks, remove the sand and sediment therefrom, and sever the black part of the neck. The cleansing process is continued by placing the meat in a cylindical perforated washing machine, which revolves automatically half a turn both ways in a tank filled with water. Any sediment that may have remained after the hand operations were completed is thus removed. The clams are now ready to be canned and are taken directly to the filling tables if whole clams are packed, or to the grinder if the minced variety is desired. The

cans are filled by hand with both meat and juice, after which they pass through the topping and sealing machines and are sealed. The process is completed by cooking the canned product in retorts at a temperature of about 245° F. from 1 to 1½ hours, depending upon the size of the container used. The juice which is thrown off in the process is used in preparing the finished product, the surplus being sealed in cans.

ANCHOVY PASTE

Anchovy paste from sprats may be made as follows: Sufficient for a peck of sprats—2 pounds of common salt, 3 ounces of bay salt, 1 pound of saltpeter, 2 ounces of prunella, and a few grains of cochineal, pounded well together in a mortar; into a stone jar place first a layer of fish, then of the pounded ingredients, and so on until the jar is filled; press them hard down and cover closely. After 6 months they will be ready for use.

Note: Persons using such preservatives as saltpeter should consult the Bureau of Chemistry, Washington, D. C., to determine whether they are using an amount in excess of that held to be proper under existing law.

ANCHOVY BUTTER

Take 1 part of anchovies which have been beaten to a paste, and pass through a sieve; add 2 parts of butter, and spice to suit. Cayenne pepper or paprika may be used to advantage.

ANCHOVY ESSENCE

Anchovy essence can be made with either canned or bottled anchovies. Take the fish, and rub to a pulp in a mortar, and then pass through a fine sieve. To ¼ pound of anchovies add ¼ pound of water; boil 15 minutes, and strain; then add ½ ounce of salt and ½ ounce of flour, and the pulped anchovies. The mixture is allowed to simmer over the fire for 3 or 4 minutes. After the preparation is cool add 2 ounces of strong vinegar. The product should be bottled in small bottles and tightly corked and covered with bottle wax.

ANCHOVY PASTE

Prepared by taking 1 pound of anchovies, 1 pound of water, and 2¼ ounces of salt and 2¼ ounces of flour; add a small quantity of cayenne pepper (say $\frac{1}{10}$ ounce), a small quantity of grated lemon peel, and ½ ounce of mushroom catsup.

ANCHOVY SAUCE

Take 3 or 4 anchovies, and chop them fine; add 3 ounces of butter, 2 ounces of water, 1 ounce of vinegar, and 1 ounce of flour. Melt the but-

ter over a water bath, add the water and the vinegar, and lastly the flour and the anchovies; stir until the mixture is thick, then rub through a wire sieve. This preparation should be kept on ice, and will not keep indefinitely.

MUSHROOM CATSUP

Upon a suitable quantity of the fresh mushrooms sprinkle salt (about 1 to 4 of the fungi), and after 3 days squeeze out the juice. To every gallon of juice add black pepper, ginger and cloves, of each ½ ounce; pimento, 2 ounces; mustard seed, 2 ounces; and a sufficient quantity of salt. Boil for 5 minutes and set aside to settle. Strain after 7 days.

CHRISTIANA ANCHOVIES

In the preparation of Christiana anchovies many methods and flavoring ingredients are used, depending on the skill and ideas of the curer and the markets for which the preparation is intended. The following is one of the most popular processes:

The fresh sprat or anchovies are immersed in brine for 12 or 18 hours, 15 pounds of Liverpool salt being used for each 100 pounds of fish. On removal, the fish are drained in a sieve and then loosely packed in a barrel, with the following ingredients, which have previously been finely crushed and well mixed: 4 pounds of Luneburg salt, 6 units of pepper, 6 units of sugar, 6 units of English spices, 1 unit of cloves, 1 unit of nutmeg, and 1 unit of Spanish pepper. The anchovies remain saturated with these ingredients for 2 weeks, when they are repacked tightly in kegs or barrels, being carefully arranged in layers, with the backs downward. A quantity of the ingredients above mentioned is sprinkled over each layer, with the addition of a few cut bay leaves or cherry leaves. At the bottom and the top of the package are placed two whole bay leaves, but, before the top leaves are laid on, brine is poured over the fish. The barrels or kegs are then coopered and rotated daily for the first few days, and after that every other day for 2 or 3 weeks.

The following process is also used to some extent:

The fish are salted for 24 hours and next immersed in sweetened water, 20 parts of water to 1 part of sugar being used. The fish are then packed with a mixture of Luneburg salt with 90 units or parts of allspice, 60 units of pulverized sugar, 19 units of whole peppers, 15 units of cloves, an equal quantity of nutmeg or mace and of hops (Origanum creticum), and some bay leaves.

The following is a choice method of preparing "Matjeshering" in Germany:

Fresh full herring, both spawners and milters, are well washed, and the

gills, stomach, and intestines are removed in such a way as not to necessitate cutting the throat or abdomen, this being accomplished by pulling them through the gill flap. The fish are next immersed for 12 or 18 hours in a 7% solution of white-wine vinegar, from which they must be removed before the skin becomes flabby and be wiped dry and covered with a preparation composed of 2 pounds of salt, 1 pound of powdered sugar, this quantity being sufficient for 75 herring. The fish are then packed in a barrel, which is sealed. When there is not sufficient brine to fill the barrel, additional should be made of 1 part of the above mixture and 4 parts of water which has been boiled.

Spiced herring (Gewurzhering) are prepared in Germany in the manner above described, with the addition of spices mixed with the salt. The spices commonly used consist of 1 part of Spanish pepper, 5 parts of white pepper, 4 parts of cloves, 2½ parts of ginger, an equal quantity of mustard, and a particle of mace and of Spanish marjoram, with a few bay leaves scattered between the layers.

FRIED FOODS

Fried foods today offer to the food manufacturer and the baker, an opportunity to add to his general line of merchandise such products as fried noodles, pies, doughnuts, crullers, potato chips, etc. The frying of foods in fat is an art which can be acquired after little experience. Properly fried foods have a special, delicate flavor which can be obtained when they are manufactured under the strictest regulation of temperature and time control. The success of fried foods depends primarily on the use of proper equipment, appropriate fat, the correct methods of preparation, and the necessary care of the fat frying equipment.

The quality of fried foods depends on the quality of the fat, which should meet requirements, such as having a low absorption value (i.e., the fat should be able to permeate and fry food easily), a high smoking point, a long frying life, leave the food with a dry, non-greasy surface and impart good flavor, must be digestible, stand up against rancidity and not give off disagreeable fumes under normal, frying conditions.

In the frying of food products, fresh fat and oil are continually added to replace the absorbed fat. If the consumption of frying fat is rapid, the level of the fat must not be allowed to get too low. All frying fats eventually break down when used at usual frying temperatures, the most stable frying fats breaking down the least. When a large amount of frying fat is present in the kettle, an excess of frying fat breaks down at the frying temperature. It, therefore, follows that, when the amount of food that has to be fried is small in proportion to the total fat in the kettle,

there is apt to be more than the usual breakdown of fat. To obtain the best results in frying foods, a kettle of appropriate size (not too large) and the smallest quantity of fat possible, should be used. As the fat is being used up, burnt food particles collect, which, if not removed, may cause smoking, and will shorten the frying life of the fat. A procedure for removing burnt food particles is to strain the fat through several layers of cheese cloth. If this method is unsatisfactory, the fat can be conditioned by drawing it off into a separate receptacle and cooling it to 212° F., after which the addition of hot water drags the burnt particles down to the bottom of the receptacle. The water and sediment can then be drawn off by means of a spigot on the bottom of the container. The proper time to replace all of the frying fat is determined by tasting the fried food daily; if the product has a noticeable flavor of cooked fat, the fat should be discarded.

POTATO CHIPS:

The manufacture of potato chips offers an easily saleable product, with far reaching applications. The best results are obtained from second crop potatoes grown in a dry, sandy soil, although Colorado potatoes are also very good. Regardless of variety, however, it is very important to pre-determine the proper soaking time and frying temperature. The preparation of the potato for frying involves peeling (by hand or machine), cutting out the eyes, and slicing by machine into a tank of cool water. The chips are allowed to soak for ½ to 2 hours, the exact time to be determined from experience with a particular type of potato. The sliced potatoes are then removed from the water, allowed to drain for a few minutes and then fried.

A satisfactory fried chip is obtained by frying at a temperature of 200° to 230° F. The chips are usually lowered into the frying oil by means of wire baskets, one pound of sliced chips to every 25 pounds of fat roughly representing the average quantity of chips for one batch. The average frying time is from 3 to 5 minutes, with allowances for the degree of browning desired. After frying, the chips must drain thoroughly, the wire basket being hung either above the frying kettle or removed to a metal draining shelf (the chips should be kept warm during the draining procedure). Salt is then applied at any time after the chips are free from excess fat, the amount added depending upon individual taste. The chips are then thoroughly cooled before packaging, to prevent sweating and sogginess in the containers.

NUTS, FRIED AND SALTED:

A popular demand for fried, salted nuts in this country is steadily increasing. Nuts have become important from the standpoint of nutrition, since they possess concentrated energy in the form of protein and fats. Only good sound nuts should be used for frying, the most desirable nut being one that has had a chance to dry out, since high moisture may result in toughness, whereas low moisture renders a crisp, tender product. The storage temperature of nuts until ready for frying should be from 50° to 70° F.

Nut meats are specially prepared and can be purchased ready for frying. Peanuts may be fried with or without the skins, while almonds and Brazil nuts are always fried without their skins. The same equipment can be used for frying nuts as for frying other foods, with the exception that the wire basket be of a finer mesh. The determination of correct frying temperature for nut meats depends on the type of nut, the size and the price obtainable for the finished product. Fat absorption in the nut meat should be held to a minimum from the standpoint of cost; small nuts (such as unblanched Spanish peanuts) should be fried at high temperatures, whereas larger nuts should be fried at lower temperatures, resulting in a more uniform color as well as increased yield.

The frying of nuts is simple, about one pound of nuts for every fifteen pounds of fat in the frying kettle representing a normal batch.

UNBLANCHED SPANISH PEANUTS:

These nuts should be fried as rapidly as possible at 360 to 380° F. to a cream color; the frying time is 16 to 18 minutes, the yield 98 to 99 percent.

BLANCHED SPANISH NUTS:

The nuts should be continually stirred at a frying temperature of 350° F., until the desired color is obtained, with a yield of 98 to 99 percent.

BLANCHED JUMBO VIRGINIA PEANUTS:

To obtain a uniform color, a frying temperature of 300° F. is usually about right. The time required should be around 12 minutes, the yield 100%.

UNBLANCHED JUMBO VIRGINIA REDSKIN NUTS:

These nuts are fried at 300° F. for 20 to 25 minutes. This should give a product an even cream color, with a yield of 101 to 103 percent.

CASHEW NUTS:

The cashew is a very delicate nut meat and since it colors rapidly, should be fried very slowly. The frying should be started at 200° F., gradually increasing the temperature to 275°. Uniform results are obtained by frying for approximately 35 to 40 minutes. To make sure that the cashews are fried throughout, the temperature should be increased slowly at the start. The yield is 100 to 106 percent.

PECANS:

The pecan is a very delicate nut and is one of the most difficult to fry. It has a high natural oil content and its softness causes shriveling and darkening if the temperature of the frying fat is not properly regulated; if it is underfried, the nut is soft and lacking in crispness. A frying temperature of 175° F. with a gradual increase to 240° F. is most desirable, for a period of 15 to 18 minutes. The yield should be 112 to 114 percent.

ALMONDS:

This nut meat should be fried slowly, continually stirred and must not be allowed to color very deeply. The starting temperature of 160° F. with a gradual increase to 240° F., should prove satisfactory, if applied for approximately 25 minutes. Before the almonds are fried, they should be soaked in water, blanched, and then dried in a heated cabinet with careful stirring. Overheating must be avoided or premature rancidity may be the result.

After frying nut meats they should be cooled as rapidly as possible, spread in thin layers on appropriate pans and cooled, with cool air blown over and under them by means of an electric fan or other methods. The nuts should be salted with a very fine salt while warm enough to cause even adherence of the salt particles, two pounds of salt usually being required for salting a hundred pounds of fried nuts. The nuts should be strained with a 10% gum arabic solution in water before salting.

Nut meats fried in fat with a high melting point produce a drier surface than when fried in liquid oils, while nut meats subjected to cold temperatures may become dull or lack in gloss. These nuts may be reconditioned quickly by rapidly frying, cooling and then sprinkling them with a liquid oil, before salting while the nuts are still warm. One to two pounds of liquid oil per hundred pounds of nut meat will bring about a new gloss.

The development of foam in frying oil baths after several days of frying is the result of the impurities coming out of the nut meats. These impurities are almost gelatinous in nature, representing gums, resins, etc.

These contaminating ingredients retard normal filtration since they quickly clog straining cloths, small filters, etc. It is, therefore, suggested that the impurities be removed from the frying oil at the end of each day to clear the surface of the nut. Foaming does not always mean that the fat has broken down. Removal of these impurities in most cases eliminates foaming and the fat can then be used for further frying.

FRIED SOY BEANS:

The soya bean has for centuries been an important means of food in the Far East and in this country is becoming increasingly important. Production has expanded tremendously and considerable research work is constantly being done on the soya bean. The fried soya bean is a pleasing nut-like confection, which will prove a product of sufficient interest to many lovers of nut meats. There are many varieties of beans of which some are better than others for frying food purposes. Experience has shown that the Illine variety is preferable, although other varieties can be fried satisfactory, e.g., Rohusum, Mammoth Yellow, Dixi, Easy Cook, and Hohto. By writing to the National Soya Bean Oil Manufacturers Association, Box 388, Taylorville, Illinois, all information on the bean and sources of supply will be gladly furnished.

Before frying the soya bean, it should be washed in water to remove particles of dirt that may be adhering. In order to obtain a good product with a nut-like texture, the bean is allowed to swell by soaking in boiling water for a period of ten minutes. The water is drained off, the beans cooled and fried. The beans are then placed in a proper wire basket, with five pounds of fat, previously heated to 370° to 380° F. The addition of the bean to the fat will cause a drop in temperature to about 340° to 355° F., at which point most of the frying takes place. Temperature control is important since frying at high temperatures produces a bean with a scorched flavor, while frying at too low temperatures produces a product with a "beany" instead of a nutty flavor. After frying, the beans are drained, salted and cooled in the same manner as other fried nut meats.

FRIED NOODLES:

There are a number of methods for making fried noodles. One is to roll out the noodle dough very thin, roll up the dough to prevent drying out, cut it into thin slices and fry at a temperature of 365 to 375° F. Noodles made this way are very superior and delicious for serving with chop suey, chow mein and other fine food dishes requiring a crisp, brown noodle.

A second method for making fried noodles is to take the dried noodle, boil it in water until soft and tender. These noodles are then fried at a

temperature of 365 to 375° F., but have a distinctly different flavor from the ones made by the first method. These noodles, after frying, should be salted, cooled and served with cooling drinks and salads. Fried noodle products are perishable, being saleable over a three to five day period, or for a longer time if properly packaged.

FRIED NOODLES

Flour	5 lb.
Water	1 lb.
Eggs	1 lb.
Salt	2 oz.

Mix the above ingredients together to form a smooth dough, which is then rolled out, partially dried and then rolled up and cut into thin slices. The cut noodles are allowed to dry and then fried.

CHEESE STICKS:

These newly developed fried products have a pleasant taste, are appetizing and make ideal additions to salads, drinks and lunches. The method for making the sticks is to roll out the dough to a thickness of 1/4 inch, cut into strips, roll into sticks and fry at a temperature of 370° to 380° F. The sticks are then removed, allowed to drain and salted; cheese sticks can also be baked if desired.

CHEESE STICKS

Formula

Flour	1 lb.
Grated Cheese	1 lb., 4 oz.
Baking Powder	1/2 oz.
Salt	1/4 oz.
Pepper	1/16 oz.
Eggs	6 oz.
Paprika	1/16 oz.

The above ingredients are mixed together with a sufficient quantity of milk to make a stiff batter.

HEALTH FOODS

Natural and vitamin-laden health-building foods and drinks are essential for the building of healthy muscles, nerves, glands, and for the growth and maintenance of a healthy, vigorous, and sound mind. The best diets are those containing plenty of fresh, crisp, and green-leaved vegetables, fresh berries, fruits or their juices, honey, grapefruit, marmalade, raspberry and strawberry jam, sun-dried bananas, nuts, and cheeses.

Nuts and soya beans are good substitutes for meats, fish, eggs, and sea foods. Pistachio nuts are non-acid-forming, rich in organic salts and vitamins. It is also rich in easily digested fats and carbohydrates. Its high percentage in alkaline minerals makes it an alkaline-yielding food. Next to the pistachio nut, both in nutritional value and least acid-forming properties, is the coconut. While not very high in total mineral content, it is rich in alkaline minerals, and its carbohydrates are easily digested. When finely ground its fibrous cellulose supplies very good bulk. In its fresh state, both the water and its soft meat are delicious and nourishing, a drink and food respectively. Properly ripened in its fresh state it has vitamins A and B. The next nut in order of its nutritional value and least acid-forming is the cashew nut, which is rich in proteins and low in carbohydrates. Next in order of the least acidity is the pecan nut, which is also rich in mineral salts. Next to the avocado pear, it is the best kind of emulsified fat to eat. The sweet almond, of which there are many varieties, is rich in vitamin A and fairly rich in vitamin B. Although it is fairly rich in alkaline minerals (though relatively low in potassium), yet, on account of its excessively high phosphorus content (the highest known in the vegetable kingdom, according to latest most authoritative analyses), it is decidedly acid in reaction. In making butter or meal, the skin should never be used. Blanching is very easily done by throwing the almonds into hot water, and after a minute the skin separates, and the almonds then should be removed and the skin easily wiped off. The meal is rich in protein, sugar, and minerals. The bitter almond average protein content is 10% higher, and 10% lower in fat content, then the sweet almond. But because of the high content of amygdalin (a poisonous chemical alkaloid), bitter almonds are inedible, due to danger of hydrocyanic acid poisoning. Although present also in other seeds of the group (drupes), of the apricot, cherry, prune, peach, etc., species, excepting the sweet almond, it is especially high in the bitter almond, the amount varying from 2.5% to 3.5%. It is split up by various reagents and by enzymes in the seed into benzaldehyde, glucose, and hydrocyanic acid. Benzaldehyde is the chief constituent of the essential oil of bitter almonds, prepared by distillation from the seed.

The oil of sweet almond is sweet and bland—and nourishing. It is often adulterated with the similar oils from peach, apricot, or plum kernels, which so resemble it as to render detection difficult or uncertain.

The next nut in order of its nutritional value and acid-forming properties is the paradise (also called sapucaia) nut, a native of Brazil. In appearance and general structure it very much resembles the Brazil (also known as Para) nut, except that it is higher in protein and fat, and lower in mineral content, yet it is considered superior to the Brazil. The Brazil

nut therefore comes next in order in the scale of nuts with respect to their nutritional value and acid-forming properties. Both however, are acid-forming, but both are rich in vitamin B and have some A and C.

Next comes the filbert (a native of Italy), which is the best of the hazel nut genus. It is also grown in England and the United States, where it is known as the hazel nut, but it is not as good as the native Italian filbert. Although in protein content it is a little lower than the Brazil, and also a more complete protein, yet in all other respects it is inferior to it. It is also less acid-forming than the Brazil and has the same vitamins A, B, and C, yet it is not so easily digestible as the Brazil.

Next in order comes the hickory nut. Although its exact chemical properties have not yet been fully analyzed in detail, yet it is considered superior to butternut on account of its lower and better quality protein content, although it is lower in its mineral content than the butternut. It also has vitamins A and (rich in) B.

Next in order is butternut. As stated, it is richer in minerals than the hickory nut but both are acid-forming on account of their high acid-forming minerals. Butternut is especially recommended for those who want to avoid carbohydrates, as it is lowest in carbohydrates of all nuts, although in fat it is nearly as high as the hickory. Its vitamin content is unknown.

Next in order comes the walnut, which really belongs to the same genus as hickory and pecan. But on account of its inferior quality and higher quantitative protein content it ranks much lower than pecan, and also lower than the hickory. It is also lower in mineral content than the hickory and more acid-forming. Also high in fat and starch content. It has a small amount of vitamin B with traces of vitamin A. Of its many varieties, the black is the best, because of its lower carbohydrates and considerably lower in fat. Next in order of the different varieties come the Japanese walnut, and last ranks the English walnut grown in the United States. The analyses available indicate that black walnut, Japanese walnut, and butternut are characterized by relatively high protein and low oil; English walnut, hickory, and pecan, by their relatively low protein and high fat content—the pecan is highest in fat and lowest in protein of the three.

PINE NUTS:

The various species of the pine family nuts differ greatly in their composition. The oil content usually exceeds that of all other constituents and is often several times the protein content. Starch is a minor constituent, at least in the species growing in Europe and the United States. Analyses of the Brazilian pine nut are not available. The European and

Brazilian nuts are longer than those growing in the United States, which have the further disadvantage of being thick-shelled. The European varieties are, therefore, more popular and mostly used in this country, where it is known as pignolia. Italy and Spain are the chief sources of its supply in this country.

The pine nut or pignolia is the highest in protein of all nuts (the only other vegetable protein that excels it is the soy bean), but it ranks low in carbohydrates, and its mineral content is highest of all nuts, especially the Italian varieties, in this respect ranking above the pistachio. But, on account of its high protein and phosphorus content, it is not alkaline. It has some vitamin B. The protein content of pine nuts is incomplete. This distinguishes them from genuine nuts.

Beechnut ranks high as a fat-containing food. It is quite high in protein and minerals, of which phosphorus is highest, which makes it an acid-forming food.

The oil is expressed on a small scale in Europe and is used for foods and lighting. Beechnut cake is a distinctly European product, as the American nut is not gathered on a commercial scale. The nut is pressed, either whole or after shelling, and the cake utilized as a cattle food. The cake has been stated to be injurious to horses. No evidence is available that the nut kernel is injurious to human beings. A toxic substance, fagin, was claimed to be an ingredient of it. Later analyses isolated cholin and showed it to be identical with fagin.

Peanuts, erroneously regarded by the popular mind as nuts, are legumes, therefore belong to the same family as soy beans, etc. The protein content is high. They are also high in fat and carbohydrates, as well as in mineral salts, of which phosphorus predominates and excels the potassium, which is their highest alkaline element, next in order being magnesium, which excels sulphur. On account of their incomplete protein and partly digestible fat, high purine, as well as phosphorus and sulphur, they are a high acid food. They have some vitamin A and considerable vitamin B. Originally a native of Brazil, the peanut is now grown throughout the tropics and warmer regions of the temperate zone. Large seeded peanuts (commonly called the Chinese variety) are grown in Virginia and Georgia in large quantities. The small seeded Spanish and African varieties are much superior to the former. Both varieties are richer in minerals, but higher in protein and fat, and lower in fiber, than both the American and Spanish grown.

Peanut butter is manufactured in immense quantities in the United States, but it is usually made of roasted and salted peanuts. The butter made of the Spanish peanut is much superior in flavor as well as in nutritional value.

SOY BEAN:

The soy bean is justly entitled to be called the king of the legumes. Not only because it is lowest in starch but also because, firstly, it is the most complete and best protein for both growing children and adults and, secondly because of its unusually high mineral content being quite high in the alkaline potassium, calcium, and magnesium, and also some sodium, and iron, manganese and copper. Although it has a high phosphorus content it is an alkaline food. It is also rich in vitamin B, and has considerable vitamin A. Its fat content is high quantitatively as well as of rich quality. Whatever starch is found in it is only in unripe and insufficiently matured seeds, but does not occur in ripe and mature seeds in most of the varieties. It is also rich in enzymes and co-enzymes, especially in its germinated state.

"A native of the Far East, the soy bean has been cultivated since the dawn of civilization in China and Japan, where the seeds furnish millions of human beings with food. From the seeds are prepared soy cheeses (Tofu, Nattomiso), soy milk (also butter, spread, loaf, and bologna), and soy sauce, the latter being used in chop suey. Because of the absence of starch in many varieties soy bean flour has come into use in the Occident as a diabetic food. Soy bean oil is of growing industrial importance." (From "Structure and Composition of Foods," by Winton.)

CHINESE BEAN (ALSO KNOWN AS CHOY SPROUTS):

Tiny, round, green, pea-shaped. Although high in carbohydrates, it is very rich in alkaline minerals and, therefore, is a non-acid-forming food. Its vitamin content is unknown. Requires no soaking and little cooking.

CHIC PEA (ALSO KNOWN AS GARBANZA BEAN):

Comes next in order of the legumes. Although rather high in carbohydrates, it is relatively low in protein, exceptionally high in magnesium, fairly high in potassium, some calcium, iron, and sodium. Although also high in phosphorus, it is regarded as a non-acid-forming food. Has considerable vitamin B and some vitamin A. It is one of the few highly nourishing legumes and vegetables. It is best eaten in its green state when obtainable.

STRING BEANS:

Fresh only. Rather low in protein and carbohydrates, high in potassium, calcium, magnesium; also considearble sodium and some iron. Much lower in phosphorus and five times the amount of sulphur, six times the amount of chlorine than in soy beans, yet is non-acid-forming

food. Is rather high in vitamin B. When not overcooked it is one of the most nourishing legumes.

KIDNEY BEANS:

In the green state it is much superior to the dried, being low in protein and carbohydrates, high in potassium, calcium, and considerable sodium, magnesium, and some iron. Not very high in phosphorus but considerably higher in sulphur and chlorine than in the dried state, but, on account of its high phosphorus content and lower potassium and sodium in the dried state, it is acid-forming when dry but not so in the green state. The red kidney is richer in minerals than is the white, and therefore to be preferred to the latter. But a better one than both in every respect is the French green kidney bean known as the flageolet. In its fresh state it is still better.

GREEN PEAS:

Come next in order for their low protein and fat content, although not very high in mineral content, of which potassium is highest, next is phosphorus and sulphur, and considerable of magnesium, calcium, sodium, and some iron. It is best in the raw, tender, fresh condition, being very high in vitamin C and rich in vitamins A and B, while in the dried condition vitamin C almost disappears and the other vitamins are reduced in half, although vitamin G or B-2 appears in considerable quantities.

LENTILS:

There are several varieties, of which the Egyptian is the best. Next comes the Russian, with the Chilean and German last. Although rather high in protein and carbohydrates, it is low in fat and high in minerals, of which potassium is highest, next is sodium, calcium, magnesium, and iron, and although its phosphorus content is high it is not an acid-forming food as far as the Egyptian and Russian varieties go. Also high in vitamins B-1 and A, and, in the sprouted form, also vitamin C.

LIMA BEAN:

Is best in its green state. Very high in potassium, sodium, magnesium, considerable calcium and some iron. Also considerable phosphorus and sulphur, and some chlorine, but, on account of its high alkaline salts and low protein, is an alkaline food. It is quite another story with the dried lima bean. It is almost three times the amount of protein and carbohydrates, lower in potassium as well as every other mineral, although its mineral proportion relatively is higher. Vitamin content is unknown. Many commercial sources claim that the dried lima bean is alkaline,

which is not true on account of its high protein and carbohydrate content. The green one is alkaline. The small ("baby") lima is best.

Fava bean (of which the Canary Mexican is the best) comes next, and in some respects is even superior to the domestic lima bean.

Horse bean is very similar to the lima bean except that it has considerably less fat as well as alkaline minerals, and is much higher in phosphorus. Although lower in carbohydrates, it is still an acid-forming food. Vitamin content is unknown.

ACORNS:

Very high carbohydrate and fat food, fairly high in minerals, potassium being the highest, next phosphorus, calcium, magnesium, sulphur, and small quantities of chlorine, iron, and sodium. Although it is low in protein it is of an inferior quality, and on account of its high carbohydrate content it is highly acid. It has a small amount of vitamins A and B. It is fit only for animals.

Chestnut belongs to the same oak (acorn) family and resembles the acorn except that it has a sweet taste while the acorn has a bitter taste. This is due to the sugar content of the chestnut. It is higher in protein and carbohydrates and much lower in fat than the acorn. It is also a little higher in mineral content, but much higher in sulphur and therefore considerably more acid-forming. It has only a small amount of vitamin B.

CEREALS AND THEIR RESPECTIVE FOOD VALUES

BREADFRUIT

A tropical, starchy fruit which heads the list of cereals strictly speaking. It is best eaten baked on hot stones (fireless cooking in the genuine sense). It is also edible raw when thoroughly ripe, when the starch is nearly totally converted into sugar. It is rich in minerals and some vitamins.

Banana is not strictly a cereal, but being a typically starchy food—like the breadfruit—is also included. When ripened, at least partly, on the stalk it grows on, it is lower in starch content, and non-acid-forming. There are many different kinds, sizes and shapes. The most delicious and richest is the (large) Samoan variety—seldom exported. Those ordinarily imported are picked too green to ever ripen properly. The longer the banana remains on the stalk before cutting, the rounder it becomes. The tropically ripened sun-dried banana is preferable to those "ripened" here. The banana thus ripened is naturally rich in vitamins and minerals and is of great nutritional value. In powdered form it is the best baby

food as well as a building food for underweight adults. (See sun-dried bananas.)

POTATO

While strictly a vegetable of the bulb family, yet, because of its starch content, can be classed with the cereals. On account of its high alkaline mineral ingredients, in particular potassium, it is not only a valuable and economical food but also non-acid-forming. It goes without saying that the most nourishing part of the potato is found near and in the skin, the parts usually peeled off and thrown away. It is best eaten in the steamed or baked form, with the skin and all. The many varieties of sweet potato vary in their relative nutritional properties, but they are superior to the Irish potato. This includes also yams of some varieties.

WILD RICE (Also Known as Indian, Water or Black Rice and Water Oats)

Stands next on top in the list of cereals for its rich nutritional value, especially in minerals and some vitamins. Also for its relatively low starch content. The Indians parch it and eat it in that state, but when cooked it is a most delectable dish, especially when prepared with some vegetable like onions, etc. It need not be soaked or cooked as long as ordinary rice on account of its low starch content. From 15 to 25 minutes' steaming in a waterless steamer is all that is needed. In its sun-dried (unparched) state it has even higher food value.

BARLEY, WHOLE

Relatively low in protein and fat and, although high in carbohydrates, is rich in potassium and magnesium; also has considerable calcium and sodium. Although rather high in phosphorus, it is low in the other acid-forming minerals and, therefore, least acid-forming of the other cereals named below. Has considerable vitamin B-1 and some vitamin A.

BUCKWHEAT, WHOLE

Only a little higher in protein, fat, and carbohydrates, and also in minerals, than barley, although a little lower in potassium and magnesium, and also in phosphorus and sulphur as well as silicon.

CORN, WHOLE, UNBOLTED

While high in carbohydrates, is relatively low in protein and rather high in fat; also in phosphorus. Is rich in vitamins B-1 and A. The yellow corn is best and is most nourishing.

WHEAT, WHOLE

Relatively high in protein, fat, and carbohydrates, it is also relatively high in minerals, being rich in potassium and magnesium, and rather high in phosphorus. Also rich in vitamins A, B, and E. Of the various wheats, the western hard spring wheat is the best.

WHEAT GERM

Is far superior to any of the cereals mentioned because of its high mineral and vitamin content and low starch. Very rich in vitamins B-1 and E and also considerable B-2 and A. Cooking destroys nearly all of its nutritional value. May be sprinkled on salads or other foods.

RICE, WHOLE, UNPEELED AND UNPOLISHED

Comes next to wheat in order as cereal. Rich in vitamins B and E. Is rapidly spoiled by storing

RICE POLISHINGS

Stand next in order to wheat germ as superior to any cereal, in particular on account of their high vitamin B content, which is highly nourishing food for the nerves. Like wheat germ, it must not be cooked. May be added to any other food cooked or raw. May also be added to wheat germ. Both, or either, may also be used as a thickener for soups, etc.

RYE, WHOLE

Comes next in order. While lower in protein, fat and carbohydrates, it is also lower in minerals than wheat. It is rich in vitamin B and has considerable of A and E.

OATS, WHOLE

Is the fourth highest in proteins of all cereals (wheat, rye, and corn being higher); highest in fat (corn being next); relatively low in carbohydrates and high in minerals, especially potassium and phosphorus, also has considerable magnesium, calcium, and sodium, and some iron; but is highly acid-forming. Contains considerable of vitamin B and some E and G, and traces of A. Also has some zinc, manganese, copper, aluminum, and arsenic. Steel-cut oats are fairly hard to digest, and therefore unsuitable for raw food diet.

MILLET (Also Known in the U. S. as Proso—Derived from the Russian)

Belongs to the same family as the sorghum and closely related to it, but its better varieties are somewhat superior to sorghum.

SORGHUM (Also Known as Indian Millet)

Embracing also durra, comes next in order. Small quantity vitamin B. Highly acid-forming.

SUGAR- AND STARCH-FREE FOOD FORMULAE

VANILLA DESSERT

Formula No. 1

Skimmed Milk Powder	77 oz.
Powdered Agar-Agar	10 oz.
Tartrazine Color	Trace
Vanillin	Enough to flavor
Saccharin	Enough to sweeten

Use 3½ ounces to 1 pint of hot water or milk, or a mixture of both.

Formula No. 2

Skimmed Milk Powder	70 oz.
Soluble Casein Powder	10 oz.
Powdered Agar-Agar	10 oz.
Tartrazine Color	Enough to color
Vanillin	Enough to flavor
Saccharin	Enough to sweeten

Use 3–3½ ounces to 1 pint of hot water or milk, or a mixture of both.

Formula No. 3

Skimmed Milk Powder	60 oz.
Powdered Gum Acacia	20 oz.
Powdered Agar-Agar	8 oz.
Tartrazine Color	Enough to color
Vanillin	Enough to flavor
Saccharin	Enough to sweeten

Use 3–3½ ounces to 1 pint of hot water or milk, or a mixture of both.

CHOCOLATE FLAVORED DESSERTS

Formula No. 1

Skimmed Milk Powder	65 oz.
Cocoa Powder	20 oz.
Powdered Agar-Agar	15 oz.
Vanillin	Enough to flavor
Saccharin	Enough to sweeten

Use 3–3½ ounces to 1 pint of hot water or milk, or a mixture of both.

Formula No. 2

Skimmed Milk Powder	70 oz.
Cocoa Powder	10 oz.
Bitter Chocolate, Powdered	5 oz.
Powdered Agar-Agar	15 oz.
Vanillin	Enough to flavor
Saccharin	Enough to sweeten

Use 3–3½ ounces to 1 pint of hot water or milk, or a mixture of both.

Formula No. 3

Skimmed Milk	12 oz.
Cocoa Powder	35 oz.
Powdered Gum Acacia	40 oz.
Powdered Agar-Agar	12 oz.
Vanillin	Enough to flavor
Saccharin	Enough to sweeten

Use 3–3½ ounces to 1 pint of hot water or milk, or a mixture of both.

Desserts may be made with fruit flavors such as raspberry, cherry, strawberry, lemon, and lime by rubbing up the flavor with gum acacia, drying same, and then using the same ingredients as suggested above.

MANUFACTURE OF SUGARLESS JAMS

Raspberry, strawberry, grape, pineapple marmalade can be made by following the procedure suggested below:

Formula No. 1

Fruit	50 oz.
Powdered Agar-Agar	3 oz.
Gelatin	2 oz.
Glycerin	5 oz.
Powdered Gum Acacia	10 oz.
Water	35 oz.
Saccharin	Enough to flavor
Sodium Benzoate	1/10% (If desired)

Dissolve the gelatin in 5 parts of hot water. Mix the agar-agar and acacia and let soak overnight in 25 parts of water. Now add to gelatin solution, bring to boil, add fruit, and just bring to boil. Then add the glycerin. Add more water if jam seems too thick. Fill bottles while hot, cap, and then pasteurize for 35 minutes at 185° F.

SUGARLESS MARMALADE FOR DIABETICS

Formula No. 2

Lemons 1½, the peel of 1 large orange, saccharin 5 grains, water 7

ounces, gelatin ¼ ounce. Wash the orange and lemons, finely shave the skin (avoiding white pith) and chop up small; add the juice and pulp of the lemons. Put into saucepan and cover with the water. Bring to boiling point and simmer for two hours, adding water when necessary to keep to stated amount. Cut the gelatin into fine strips; add it with the saccharin to the mixture and stir for 10 minutes. Put it into a jar and leave it to set. The keeping properties of this marmalade are not very good, and if it be desired to store it for any length of time a small quantity of sulphurous acid—40 parts per million—preferably in form of potassium metabisulphite, should be added.

STARCHLESS BREAKFAST FOODS

Soy Bean Middlings
Honey or Malt Syrup

The soy bean middlings are moistened with the syrup, toasted, and then put into packages.

Bran (With all the starch removed)	90 parts
Soy Bean (Fine granulation)	10 parts

SUGARLESS CHOCOLATE BARS

Bitter Chocolate	20 oz.
Skimmed Milk Powder	50 oz.
Soy Bean Flour (Fatless)	30 oz.
Vanillin	Enough to flavor
Saccharin	Enough to sweeten

MAPELEINE SYRUP, SUGARLESS

Powdered Gum Karaya	1 oz.
Water	32 oz.
Saccharin	3 gr.
Mapeleine Extract	9 cc.
Caramel Color	Enough to suit
Salt	To taste

Whip the gum up with the cold water to a thick liquid. Then add flavor, sweetener, and color.

LEMON PIE FILLING, SUGARLESS

Powdered Gum Karaya	1 oz.
Water	12 oz.
Butter	¾ oz.
Egg Yolk	1 oz.
Lemons (Juice and skin)	2
Saccharin	2 gr.

Add water gradually to the gum and then bring to a boil. Remove from

fire. Add remaining liquid ingredients in the order given. Pour into pan lined with pie crust which has been baked and cover with meringue.

MERINGUE, SUGARLESS

Egg White	1
Saccharin	¼ gr.
Lemon Extract	¼ tsp.
Salt	To taste

To partly beaten egg white, add the other ingredients in order given until stiff. Spread over surface and bake in moderately hot oven.

CUSTARD FILLING

Egg	1
Water	½ cup
Heavy Cream	½ cup
Vanilla	1 tsp.
Saccharin	1 gr.
Nutmeg and Salt	To taste

Beat egg lightly, add salt, cream, water, saccharin, and vanilla. Strain into pie pan lined with pie crust, grate nutmeg over the top, and bake in moderately hot oven until filling sets.

PUMPKIN FILLING

Eggs	2
Heavy Cream	2 tbsp.
Mashed Pumpkin	1 cup
Water	1 tbsp.
Saccharin	1 gr.
Cinnamon	1 tsp.
Allspice	½ tsp.
Ginger	½ tsp.
Cloves	½ tsp.
Salt	½ tsp.

Beat egg lightly, add other ingredients in order given. Strain into pie pan lined with pie crust. Bake in a moderately hot oven 30 minutes.

WHITE OR CREAM SAUCE

Butter	3 tbsp.
Gum Karaya	2 tbsp.
Heavy Cream	½ cup
Water	½ cup
Salt and Pepper	To taste

Heat butter and mix with water and cream. When heated gradually sift in the gum karaya, beating or stirring until the gum is dissolved and

season. Serve hot. If thin sauce is desired use only 1 tablespoonful of gum.

FAT-FREE (NON-FATTENING) BUTTER
(LISTERS GOLDEN SPREAD)

Vaseline and Mineral Oil, U.S.P.	97 oz.
Table Salt	3 oz.
Tartrazine Color	Enough to suit
Butter Culture Flavor	Enough to suit

Listers Golden Spread is not to be used in cooking.

Listers Golden Spread and Diabetic Foods can be purchased from Lister Bros., Inc., 41 East Forty-second Street, New York City.

HEALTH DRY CEREALS

Formula No. 1

Carob Flour (St. John's Bread)	20 oz.
Soy Bean Middlings	60 oz.
Cracked Wheat	20 oz.
Salt	To taste

To be cooked up with water or milk, and served with cream.

Formula No. 2

Whole Wheat Cereal	80 oz.
Flaxseed Meal	15 oz.
Agar-Agar	5 oz.

Formula No. 3

Corn Meal	80 oz.
Flaked Dates	20 oz.

Formula No. 4

Whole Wheat Cereal	40 oz.
Whole Rice Cereal	40 oz.
Whole Wheat Bran	10 oz.
Whole Rice Bran	5 oz.
Flaxseed	5 oz.

Formula No. 5

Whole Wheat Cereal	95 oz.
Rice Polishings	5 oz.

Formula No. 6

Whole Wheat Cereal	85 oz.
Soy Bean Middlings	15 oz.
Honey	

Treat above with honey and then dry same.

Formula No. 7

Whole Wheat Cereal	85 oz.
Carrot Powder	10 oz.
Spinach Powder	5 oz.

COFFEE SUBSTITUTES AND HEALTH DRINKS

Formula No. 1

Roasted Whole Wheat	75 oz.
Roasted Whole Rye	20 oz.
Flaxseed	5 oz.

Formula No. 2

Roasted Barley	90 oz.
Roasted Bran	5 oz.
Dry Figs	5 oz.

Formula No. 3

Roasted Whole Wheat	75 oz.
Roasted Soy Bean Middlings	25 oz.

FLOUR, MEALS, ETC.

Alfalfa flour is rich in alkaline minerals and invaluable for acidosis.

Lentil, lima bean, and pea flour are very nutritious.

Soy bean flour, with or without a high percentage of fat, is used to make bread, biscuits, noodles, mayonnaise, candy, etc.

NOODLES

Kelp noodles are made with whole wheat and kelp. Spinach noodles are made with Semolina flour and spinach. Vegetable whole wheat noodles are made with whole wheat flour and a combination of carrot, spinach, and potato powders.

TEA SUBSTITUTE

Alfalfa tea is rich in alkaline organic minerals, and is sometimes combined with ground peppermint.

Mate tea is a South American nature drink.

Kelp tea is a mixture of sea weed rich in organic iodine.

VEGETABLE GELATIN

Irish moss is a starch-free powdered product for preparing pudding, jellies, and for thickening hot drinks, soups, and sauces.

Agar-agar is a product of the sea, and lends itself to the preparation of many attractive fruit agar jellies, salads, and dessert.

AGAR JELLY

Agar-Agar	3 g.
Fruit Juice	1 cup
Sugar	80 g.
Water	2 cups

Mix the agar with the sugar. Now boil the water, dissolve the sugar in it, and boil for 1 minute. Shut off the gas, add the fruit juice and enough lemon juice to acidify the dessert.

VEGETABLE SEASONING

Sea Salt	80 oz.
Kelp (Powdered)	20 oz.
Dried Alfalfa	2 oz.
Tri-Calcium Phosphate	1 oz.

NUTS

Nuts are very nutritious, and unlike cereals they are rich in fat and proteins and very poor in carbohydrates or starch. Nuts are heat and energy-producing foods, and they are also tissue builders because of their protein content. Unless special care and attention are taken nuts become rancid in a few months. Therefore they should not be stored in warm or damp places. If allowed to remain too long in the container, it is well to transfer the nuts to a fresh one.

The following data on nuts, while limited, show clearly how they are classified and graded for commercial sale.

ALMONDS

Almonds are the seeds of a tree, similar to the peach tree, indigenous to the Mediterranean countries. Before the fruit is ripe, it is not possible to say it the tree will produce a sweet or a bitter almond. One tree will always produce the same kind of a nut, never a bitter and sweet fruit together.

The principal almonds found in commerce are:

Jordan Almonds Malaga Almonds Valencia Almonds Palma Almonds Girgenti Almonds	Shipped with large seeds.
Bari or Sicilian Almonds	Small seeds, but cheap in price and good in quality.

Berber Almonds Jaffi Almonds	From North Africa. Small, bitter, frequently broken, unclean.

Domestic and imported almonds come in three grades: (1) Paper Shell, (2) Soft Shell, (3) Hard Shell.

In the U. S. almonds are cultivated in California, where they are grown by budding into seedlings of either the bitter or sweet variety. They are also imported in large quantities from France, Spain, Italy, and the Levant.

GRADES OF UNSHELLED ALMONDS

Nonpareil IXL Ne Plus Peerless Drake Seedling Langnedoc Hard Shell	First grade should crack 95% or better with good kernels.

GRADES OF SHELLED ALMONDS

Nonpareil Jumbo Nonpareil Medium Nonpareil Small	All unbroken meats, free from shell and foreign matter.
Nonpareil Sheller Run	Not more than 25% broken meats, ungraded for size. Free from shell and foreign matter.
IVL Medium	All unbroken meats, free from shell and foreign matter.
IXL Sheller Run	Not more than 25% broken meats.
Jordanettes	All unbroken meats, free from shell and foreign matter.
Drake Medium	All unbroken meats, free from shell and foreign matter.
Drake Sheller Run	Not more than 25% broken meats, free from shell and foreign matter.
Seedling Sheller Run	Seedlings of the Drake, Texas, Langnedoc, or kindred variety. Not more than 25% broken meats, free from shell and foreign matter.

BRAZIL NUTS

CREAM NUT, PARA NUT

These nuts come from a large tree in Brazil, French Guiana, and British Guiana.

They grow inside of a hard, round shell, about 5 inches in diameter, which contains from 15–25 compactly arranged nuts. The shells are very hard to break. Harvesting begins early in January. If nine out of every ten nuts cracked are good, it is considered a "good crack." There is a variety of the brazil nut which is not edible called the

BABASSEE

This nut is so rich in oil that it will burn freely if lighted.

GRADES

Large Washed, Large Medium, Medium.

BUTTER NUTS

The brown-husked, rugged nuts come from a large tree grown in the U. S. They contain oil and have a delicious flavor.

COCONUT OR COCOANUT

The fruit of a tropical palm which reaches a height of 50 feet or more and which is found in nearly all tropical regions. On an average, each tree yields about 80 units each year. The kernel of the cocoanut (copra) contains about 70% of fat, from which the cocoanut oil or cocoanut butter is expressed. The whole nuts and various desiccated products are exported.

DRIED COCOANUT

Imported from Jamaica, Panama, Trinidad, Porto Rico.

GRADES

Thread	1. Regular, about 3 inches in length. 2. Extra large, about 4 inches in length. Both white, about 1/18 inch in diameter.
Shred	Shorter than Thread.
Macaroon	Pulverized. Moisture varying from 2–6%.

COLA NUTS

The seeds of the cola tree, which is cultivated in West Africa, West India, and South America. The seeds contain 1.5% caffeine and theobromine. Used in chocolate and cola beverages.

CHESTNUT

There are five species of the true chestnut, three of which are American. In Italy and Spain they form an important part of the diet. Marrons glacés are candied chestnuts, popular both in Europe and America.

HICKORY

A genus of picturesque, hardy American tree. Hickory nuts are highly prized in the U. S. A. and were a common food among the Indians. Large quantities of the nuts are shipped to Europe.

FILBERTS, HAZELNUTS

Filberts are imported from Italy, Spain, and Turkey.

GRADES OF SHELLED FILBERTS

Italian (Naples)	Two varieties, Long Naples, Round Naples.
Spanish (Barcelona)	Round in shape, of fairly uniform size.
Turkish (Levant)	Mostly round in shape and size.

GRADES OF UNSHELLED FILBERTS

Long Naples	Long in shape.
Round Naples	Round in shape.
Barcelona	Round in shape.
Unselected	Required to crack 85% sound.

Both varieties are known to the trade as "Filberts," as they are practically alike in appearance when the husks are removed. The husk of the filbert is much longer than that of the hazelnut.

PEANUT

The peanut is a native of Brazil, but now cultivated in Africa, India, China, and in the U. S. in Virginia, North Carolina, Georgia, Texas, and Alabama.

The peanuts of the Spanish variety have a small and almost round kernel. They contain more oil than the Virginia peanuts. The kernel of the latter is large and oblong.

GRADES OF UNSHELLED PEANUTS

Hand-picked Virginia Jumbo	Containing not more than 11% of imperfect or immature nuts.
Hand-picked Virginia Fancy	Not more than 15% of imperfect or immature nuts.

Hand-picked Virginia Extra	Not more than 10% of imperfect or immature nuts.
Hand-picked White Spanish	Not more than 10% of imperfect or immature nuts.
Hand-picked Red Spanish	Not more than 15% of imperfect or immature nuts.
Hand-picked Runner	Not more than 10% of imperfect or immature nuts.
Recleaned Runner	Not more than 20% of imperfect or immature nuts.

GRADES OF SHELLED PEANUTS

Extra Large Virginia Shelled	Not more than 528 nuts per pound. Not more than 5% of imperfect or unsound nuts or foreign matter.
No. 1 Virginia Shelled	Well selected. Not more than 7% of imperfect or unsound nuts or foreign matter.
No. 2 Virginia Shelled	Broken and shriveled nuts. Not more than 10% of imperfect or unsound nuts or foreign matter.
No. 3 Virginia Shelled	Oil stock.
No. 1 Spanish Shelled	Not more than 5% of imperfect or unsound nuts or foreign matter.
No. 2 Spanish Shelled	Not more than 7% of imperfect or unsound nuts or foreign matter.
No. 3 Spanish Shelled	Oil stock.
No. 1 Runner Shelled	Not more than 5% of imperfect or unsound nuts or foreign matter.
No. 2 Runner Shelled	Not more than 7% of imperfect or unsound nuts or foreign matter.
No. 3 Runner Shelled	Oil stock.

GRADES OF BLANCHED PEANUTS

Whole Virginia Jumbo Blanched	Made from Extra Large Virginia Shelled; 80% whole nuts.
Split Virginia Jumbo Blanched	Made from Extra Large Virginia Shelled. Very small portion whole nuts, nearly all splits.

Virginia Blanched	Made from Virginia grades that have been roasted before shelling, shelled, and blanched. Largely splits, ungraded for size.
No. 1 Virginia Blanched	Made from No. 1 Virginia Shelled. Largely splits, ungraded for size.
No. 2 Virginia Blanched	The small particles that are screened out in making No. 1 Virginia Blanched.
Spanish Blanched	Splits.
No. 1 Runner Blanched	Made from No. 1 Runner Shelled. Largely splits, ungraded for size.
No. 2 Runner Blanched	The small particles that are screened out in making No. 1 Runner Blanched.

CHINESE PEANUTS

GRADES UNSHELLED

11–13 count per ounce

GRADES SHELLED

28–30 count per ounce
30–32 count per ounce
38–40 count per ounce

PECAN

A North American nut-bearing tree belonging in the same genus as the hickory. There are shelled and unshelled pecans on the market. Paper shell pecans are shipped from Georgia, Texas, and Oklahoma.

1. GEORGIA PAPER SHELL

GRADES SHELLED

Mammonth Halves	Firm, perfect halves, counting about 250 to the pound.
Jumbo Halves	Large, well-shaped halves, counting about 450 to the pound.
Selected Halves	Well-formed halves, counting about 650 to the pound.
Selected Pieces	Large meaty pieces, free from all foreign matter.
Granules	Chopped into fine pieces.

2. OKLAHOMA AND TEXAS PECANS

Are thin shell but not paper shell. They are not generally graded, but sold as "Orchard Run." The nut is of medium size and full meated.

PIGNOLIA OR PINE NUT

These nuts are the seeds of pine trees. The kernels, about the size of puffed rice, are very rich in food value and form an important article of diet for large numbers of people, especially Indians and Mexicans in the Southwest of the U. S. A. and in Mexico, where the nuts grow plentifully.

Pignolia nuts also grow in Southern Europe and some are imported into the U. S.

PILI NUTS

In the Philippine Islands there grows wild in the forests a very valuable nut, which is likely to find its way into our markets when its value becomes known. The nut of the pili is triangular and pointed at each end and has a kernel pleasant to eat, raw or roasted.

PISTACHIO NUT (PISTACHE)

The pistache or "green almond" is a small, thin-shelled nut, which is delicious to eat when roasted and salted. While the pistache is grown in a limited way in California, the main supply comes from Syria, other Mediterranean countries, and the desert countries of Asia and Africa.

GRADES CRACKED

Extra Fancy	Large size, all split, full meats, new crop, finest flavor.
Fancy	Medium size, 95% full meats.
Regular	Smaller size, 92% full meats.

GRADES SHELLED

No. 1 Cilician Extra Fancy	Uniform large size, mostly green, extra picked, clean, sweet, free from shells, particles and foreign matter.
No. 1 Cilician Fancy	Uniform size, mostly green, picked, clean, sweet, free from shells, particles and foreign matter.

WALNUT

The name is generally restricted to the European or English species and to the American black walnut.

In Southern California the "Placentia" is regarded as the best all-

around variety as it is well adapted to the soil and climate and bears nuts of a very fine quality. The first quality Placentia nuts are regarded as standard, and most of the nuts sold as "budded" are of this variety. However, any of the leading nuts which equal No. 1 Placentias in quality may be sold as budded.

FANCY VARIETIES AND GRADES

Eureka, Franquette	Grades: Jumbo, Extra Fancy, Fancy.
Mayette, Payne, Concord	Grades: Jumbo, Fancy.

STANDARD GRADES AND VARIETIES

No. 1 Soft Shell	A walnut of the Santa Barbara soft shell variety of a size that will not pass through a 1-inch square opening. Must crack from 90–100% good.
Baby Soft Shell	Same as No. 1, but smaller nuts which pass through a 1-inch square opening. Crack 90–100% good.
Large Budded	A nut of the Placentia-Perfection variety or any other budded or grafted nut of the same general characteristics and of a size that will not pass through a $1\frac{1}{8}$-inch square opening. Crack 90–100% good.
Medium Budded	Same as large budded, but will pass through a $1\frac{1}{8}$-inch square opening. Crack 90–100% good.
Near Grade	A substandard grade of walnut which cracks anywhere from 80–90% good, but otherwise equals in size and appearance the standard grade.
Off Grade	A substandard grade cracking 75–90% good; but besides being below the standard in cracking, they are below the standard in size and appearance.
Culls	Those walnuts that, either on account of cracking below 80% good or on account of defects in appearance, are not suitable for distribution to the public as unshelled walnuts and are, or at least should be, converted into by-products (shelled walnuts).

GRADES SHELLED

Light Halves	All unbroken halves. Light in color.
Light Ambers	Averaging 50% halves and 50% pieces. Light amber color.
Standard Ambers	Halves and pieces mixed. Dark amber color.

BREAD MAKING

THE MILLING OF WHEAT

Before wheat is milled into flour, it is carefully screened, scoured, washed, and dried. The cleaned wheat is then moistened under controlled temperature and moisture conditions. Wheats are also frequently blended to obtain a flour of high quality.

The wheat is then passed through a series of break rollers which are grooved. The break rolls, which revolve at different speeds, break the wheat into pieces coarse enough to permit easy removal of bran and germ. This cracked wheat is called middlings. By means of an air-blowing arrangement, the light bran particles are removed and the purified middlings are then passed through a series of reduction rolls, which cause unremoved germ and fibrous material to flake out against the smooth-faced rolls.

The middlings, which have been ground and reground, are separated into various streams of flour by sieving and bolting. The bran particles which do not pass through the sieve are termed "shorts," and go into making feedstuff. Thus we see that a perfectly manufactured white flour depends upon the complete removal of the bran, germ, and coarser particles.

In modern milling practice, 100 pounds of cleaned wheat usually yields 70 to 76 pounds of middlings, to be ground into flour of various grades, and about 24 to 30 pounds of feed. The term per cent separation or per cent extraction is the percentage of flour actually secured after all of the bran and feed has been removed. Thus, if 75 pounds of middlings free from bran and germ were milled into 75 pounds of flour, this would be considered as 100% separation or extraction. If 45 pounds were obtained, it would be a 60% separation flour. Any desired percentage separation may be obtained. Short separation flours represent a lower percentage separation or more highly refined flour than flours of longer separation. The grade of flour depends upon the perfect elimination of fiber, germ, and other impurities of the whole wheat kernel.

FLOUR

Flour readily takes up moisture or loses it. Too high a moisture content may result in a musty flour. New crop flour is sometimes high in moisture content, and such flours should be stored until normal in moisture.

Protein in flour is very important, since some which is water soluble nourishes the yeast in the dough during fermentation, while the water

insoluble protein, namely gluten, gives bread its skeleton structure or foundation.

Gluten is composed of gliadin and glutenin. Gliadin is of a sticky nature, imparting adhesiveness to the gluten, while glutenin imparts tenacity and strength. The combination of these two dissimilar proteins together with water is known as gluten.

The quantity as well as the quality of the gluten is important from the baker's viewpoint. Hard spring flour is slightly higher in gluten than grades of winter wheat flour. An average patent flour contains 10.8–12.5% of gluten. Shorter separation flours contain less gluten but of superior quality than higher per cent extraction flour milled from the same wheat.

Starch represents about 70% of the average bread flour. The small amount of maltose and sucrose present in the flour aids materially during the fermentation period. Soluble starch, cellulose, and dextrin may also be present, but in a very small amount. Damaged flour, due to intense heat and moisture, may also develop soluble starch and sugars to such an extent as to render the flour unsound. The normal fat content of patent flour is seldom over 1.5%. The clear grades of flour contain more fat than the shorter separation of patent grades. A high percentage of fat in flour may influence the development of rancidity while in storage.

Enzymes are present in flour. An enzyme is a chemical compound of animal or vegetable origin that causes chemical transformations to take place without itself being a part of those changes. There are many enzymes occurring in nature, each having a particular function or job to perform. For example, the enzyme called "Zymase" will cause cane sugar to break upon into alcohol and carbon dioxide gas. It is also due to the action of this same enzyme present in yeast that causes the bread dough to rise. "Diastase" is another enzyme and causes starches to break down into maltose and dextrose, while another enzyme "pepsin," which is present in the gastric juices, enables the human body to digest proteins in meat foods.

The important enzymes present in wheat flour are "Diastase" and "Protease." Diastase liquefies the starch granules in the dough, and then converts the liquefied starch into maltose, dextrose, and dextrines. Some believe that there are two types of diastase present in flour, a starch-liquefying enzyme and a starch-saccharifying enzyme. Diastase is necessary in the making of bread. It supplies greater gassing power to the dough, due to the conversion of starch into sugars, which in turn ferments into carbon dioxide and alcohol.

Protease, or proteolytic enzymes in flour, has the function of softening

the gluten in the dough batch, thereby imparting to it greater stretching power, strength, elasticity, and oven spring.

The strength of a flour depends a great deal upon the quality of its gluten, and also the ability of the flour to produce a large yield of loaves. A flour which will hold together during fermentation and which is not too sensitive to sudden changes of temperatures is called a stable flour. Also a flour which does not have to be taken on the minute after fermenting, and which will produce a good loaf, if taken just a little before or after its fermentation period, is said to have a good fermentation tolerance.

The amount of water required to make a dough with flour, ideal for baking bread, and a dough which does not become sticky, or too stiff, is termed as percentage absorption of the flour. The average bread-making flour will take about 60 pounds of water for each 100 pounds of flour. A dough which will slacken noticeably during fermentation should be made a little stiffer at the start, or less water should be used.

The following table briefly shows the sources of important enzymes required in bread making.

Enzyme	*Source of*	*Function*
Diastase	Flour	
	Malt syrup	
	Malt flour	
	Malted wheat flour	Converts starch into malt sugar
	Honey	Liquefies starch
Protease	Flour	
	Malt syrup	
	Malt flour	
	Malted wheat flour	Softens gluten
	Soy bean flour	Makes gluten elastic
	Carob flour	Makes protein soluble
Invertase	Yeast	Converts cane sugar into invert sugar
Maltase	Yeast	Converts malt sugar into dextrose
Zymase	Yeast	Converts invert sugar and dextrose into carbon dioxide and alcohol. The alcohol disappears during baking and the carbon dioxide raises the dough.

STANDARD FORMULAS FOR BREAD MAKING

(Straight Doughs)

	White Bread	Raisin Bread	Rye Bread	Graham Bread	Whole Wheat	French Bread
	lb.	lb.	lb.	lb.	lb.	lb.
Flour	100	100	....	65	12	100
Water	60	60	60	58	66	58
Yeast	1¾	4	1½	2	1½	1¼
Yeast Food	¼	....	....	¼	¼	6 oz.
Salt	1¾	1¾	....	2	1½	1¾
Sugar	1	3–4	....	2	1½	
Malt Syrup	1½	1½	10 oz.	1¼	1	2
Milk	4	4	....	....	2	
Shortening	2	3–5	¾	2	2	2½
Raisins	....	35–50				
1st clear	....	....	66			
White Rye Flour	....	....	8			
Dark Rye Flour	....	....	26			
Graham Flour	....	....	....	35		
Whole Wheat Flour	....	....	....	....	100	
Caraway Seed	....	....	4 oz.			
Ground Caraway Seed	....	....	4 oz.			
Temperature	78° F.	80° F.	78° F.	78° F.	79° F.	79° F.
1st Turn	1¼ hrs.	¾ hr.	2½ hrs.	1¼ hrs.	1½ hrs.	2¼ hrs.
2nd Turn	½	¼	¾	....	¾	¾
To Bench	¼	10 min.	¼	½	½	¼

SOYA BEAN FLOUR BREAD

Formula No. 1

Soya Flour	65 lb.
Wheat Flour	260 lb.
Sugar	10 lb.
Salt	5 lb.
Yeast	15 lb.
Shortening	15 lb.
Water (Variable)	210 lb.

Mix 3 minutes, ferment at 90° F.

First punch	45 min.
To bench	15 min.
Proof	45 min.
Bake	30 min.
Temperature of Oven	445° F.

Formula No. 2

Whole Soya Flour	25	lb.
Whole Wheat Flour	25	lb.
Clear	50	lb.
Dry Milk	3	lb.
Salt	1.75	lb.
Shortening	2	lb.
Yeast	2	lb.
Sugar	1.5	lb.
Dry Malt	1.5	lb.
Water, about	10	gal.

The straight dough method is employed. A rather wide range in the quantity of water to be used is permitted. This is done to allow for the particular water absorption of the whole wheat flour and the clear that may be used by the baker. A straight dough is made but the whole soya flour is soaked for half an hour with a portion of the water before the dough is made.

STANDARD FORMULAS FOR BREAD MAKING

(Sponge Doughs)

Sponge	White Bread	White Bread	Rye Bread
Flour	60 lb.	60 lb.	Rye 30 lb. Clear 30 lb.
Water	36	36	34
Yeast	1¼	1¼	1¼
Yeast Food	¼	¼	¼
Malt Syrup	¾	¾	¼
Shortening	1	1	
Temperature	76° F.	76° F.	76° F.
Time	4 hrs.	4 hrs.	4 hrs.
Dough			
Flour	40 lb.	40 lb.	Clear 40 lb.
Water	24	26	24
Salt	2	2	1¾
Sugar	1	3	
Malt Syrup	½	½	1¼
Milk (Sweet Condensed)	5 (Powder)	2–3	
Shortening	1½	1½	1
Temperature	79° F.	79° F.	79° F.
To Bench	15 min.	15 min.	20–30 min.

There are two different systems of bread making from the standpoint of mixing and handling the doughs. They are

A. Straight Dough Method
B. Sponge Dough Method

STRAIGHT DOUGH METHOD

It is straight dough method all of the ingredients are mixed together at one time and the dough is fermented and conditioned uniformly to the proper extent. This method is simple, and produces a loaf the same way each time, having desirable characteristics such as compact grain, pleasing flavor, improved eating and keeping qualities.

SPONGE DOUGH METHOD

In the system of bread making known as the sponge dough method, only a part of the flour, water, yeast, yeast food, and sometimes a little of the malt syrup and shortening are first mixed together. This dough is allowed to rise and mature, usually to a greater degree than a straight dough. After having matured to the proper extent, it is then removed with the balance of the ingredients. The final dough is then again transferred to the troughs and allowed to rise; it is conditioned for a short while and then made up into loaves in the regular way.

There are some advantages to the sponge method. A sponge dough requires less yeast than a straight dough, and can stand a longer time when ripe, or conditioned to the proper extent, than a straight dough. A loaf of greater volume, soft, and white crumb is produced by the sponge method. Cheaper grades of flour, or stronger flour, can be used in sponges to better advantage. Also, the dough can be better regulated, especially when new or young flour is used. If the sponge comes up too quickly or too slowly, you can hasten or hold back the dough by regulating the temperature of the water and increasing or reducing the amount of salt.

The advantage of straight doughs over sponge doughs is the saving of time and labor, as all the ingredients are mixed at one time, and length of fermentation can be controlled at will, according to the amount of yeast, salt, sugar, and yeast foods used. A straight dough needs more mixing than a sponge dough, or the gluten must be worked more, for elasticity. A sweeter loaf can be made by the straight dough method, also a fine rich flavor obtained with extra additions such as sugar, malt syrup, honey, milk, etc. If a long-time sponge dough method is employed, the flavor of the loaf is apt to be slightly sour and is therefore

considered much less desirable than the flavor of a loaf made by the straight dough method.

METHOD OF BREAD MAKING

Straight Dough Process

a. Preparation of ingredients.
b. Dough is mixed.
c. Dough placed in trough and fermented.
d. Dough transferred to bench.
e. Dividing and scaling.
f. Rounding of loaf.
g. Additional proofing.
h. Molding.
i. Panning.
j. Proofing in pan.
k. Baking.
l. Cooling.

Sponge Dough Process

a. Preparation of part of ingredients.
b. Sponge is mixed.
c. Sponge placed in trough and fermented.
d. Sponge placed in mixer, broken up, and mixed with other ingredients, and finally placed back in trough.
e. Allowed to rise again.
f. Dough sent to bench, dividing and scaling.
g. Rounding of loaf.
h. Additional proofing.
i. Molding.
j. Panning.
k. Proofing in pan.
l. Baking.
m. Cooling.

MIXING THE YEAST

The yeast to be used should first be made into a uniform mixture with water at room temperature. The salt, yeast foods, or malt syrup should be added as a solution to the dough, after the addition of the yeast.

MATURED DOUGH

When the dough has been properly matured in the trough, it is transferred to the bench or to the dividing machine. Here the dough is cut into individual pieces of proper weight. Under normal conditions, for white pan bread, 1 pound of bread will be produced from 17½ to 18 ounces of dough. There are many types of dividing machines. A divider cutting off one piece of dough is called a one-pocket divider. In dividing the large mass of dough, either by hand or machine, the gas in the dough is further expelled. Before each piece can be molded the dough must be given a chance to devlop sufficiently pliable for molding. Furthermore, the sides

and edges of the pieces are open, thus permitting gas formed by the continued action of the yeast to escape. Therefore, right after dividing the dough, each piece is rounded or balled up so as to put a skin around it. When the individual pieces of dough are rounded out, they should be allowed to rest, free from all drafts for about 15 minutes. This additional proofing will noticeably increase the volume, and make the bread become softer, and in this condition the bread will mold better. This short intermediate period of proofing is sometimes called short-proof, or overhead, or first proof.

MOLDING THE LOAVES

After the short-proof process, each piece of dough is molded into a dough loaf. This can be done by a machine. The dough loaves, after being molded, are placed in the pans which have been lightly greased on the bottom and sides. Before being baked, it is necessary for the dough loaves to rise once more. For ordinary pan bread, the loaves should be allowed to become at least double in size during proofing. The pan proofing cabinet should be well insulated so that a uniform temperature of 95–98° F. and a relative humidity of 80–85% are maintained.. At the proofing temperature the yeast functions vigorously, causing the dough to rise rapidly, and the high humidity prevents the dough loaves from crusting over. Proper pan proof period may range from 30 to 60 minutes. This final proofing is important, and should be accurately controlled. A healthy dough, containing liberal quantities of malt, yeast, salt, and milk will stand up best with all the abuse it receives during the proofing process and will produce a good quality loaf of bread. During the first few minutes of baking in the oven, the yeast functions more vigorously than at any time before. When the dough temperature reaches 140–150° F., fermentation ceases. There is a final rising of the dough which is secured because of the rapid production of more gas, due to the activity of the yeast. Another reason is the fact that a considerable amount of carbon dioxide gas produced in the dough prior to its entrance into the oven remains dissolved in the moisture of the dough and at the increased temperature of the dough in the oven this dissolved carbon dioxide is driven off, and aids materially in producing the desired oven spring. The alcohol produced during the fermentation evaporates in the oven.

The exact time of baking and oven temperature depends upon the size and type of bread. Oven temperatures range from 375° to 450° F. For ordinary 1-pound loaves of pan bread one-half hour bake at approximately 425° F. is about right.

DATE NUT LOAF BREAD

Bread Flour	3½ lb.
Wheat Flour	1½ lb.
Baking Powder	⅛ lb.
Baking Soda	1¾ oz.
Brown Sugar	2¼ lb.
Shortening	1½ lb.
Salt	1¼ oz.
Chopped Dates	4½ lb.
Chopped Walnuts	1 lb.
Hot Water	4½ pt.
Eggs	1 lb.

Flour the dates before chopping and then soak for 5 minutes in hot water the chopped dates and walnuts. Now add the baking soda.

While thoroughly creaming the sugar, shortening, and salt, add the eggs. Now add the warm date-walnut mixture into the cream mass and stir.

The flour and baking powder, having been sifted and mixed, should now be mixed thoroughly with the creamed mass.

Bake at 380° F. for 45 minutes, and remove the loaf from the pans while warm.

PRUNE BREAD

Flour	50 lb.
Water	28 lb.
Yeast	1½ lb.
Sugar	2 lb.
Salt	1 lb.
Milk	¾ lb.
Malt Syrup	½ lb.
Shortening	1½ lb.
Chopped Prunes	15 lb.

Allow the prunes to soak overnight in a small amount of water, and then add the sugar and shortening. After mixing the dough in the usual way, the entire batch is now mixed and worked over.

The dough is fermented at 80°–85° F.

The first punch is taken 1 hour and 30 minutes later; second punch, 45 minutes later; to the bench, 15 minutes later.

Allow to proof 15 minutes before panning.

Give medium proof and then bake in medium oven.

BRAN BREAD

Clear Flour	5	lb.
Whole Wheat Flour	1	lb.
Bran	1	lb.
Buttermilk	8	lb.
Brown Sugar	6	lb.
Eggs	1½	lb.
Salt	2	oz.
Shortening	8	oz.
Baking Soda	3	oz.
Cream of Tartar	1¼	oz.
Chopped Nuts	2	lb.

Dissolve the baking soda in the buttermilk. Now cream together the shortening, sugar, and salt, then add the eggs, buttermilk, and nuts. Now add flour, bran, cream of tartar, and mix until the batter rises a little.

Bake in paper-lined tins at 350° F. for 45 minutes.

AIDS IN BREAD MAKING

SALT

Salt improves the taste and flavor in bread, helps to control the activity of the yeast during fermentation, and assists in preventing the development of objectionable bacterial action or wild type of fermentation. Salt has a binding or strengthening effect on gluten, and thereby adds strength to any flour.

YEAST

Yeast is a microscopic, one-celled plant belonging to the group known botanically as "fungi." It ordinarily multiplies by a process known as budding and under suitable conditions causes fermentation. Each yeast plant is rounded or oval and measures from 1/3600 inch in diameter. Each cell is surrounded by a thin membrane of celluose, and the interior of each cell is made up of fine granular protoplasm.

The chief enzymes of yeast are invertase, maltase, zymase, and protease.

SUGAR

The following sugar products are used in bread making:

a. Brown sugar.
b. Molasses.
c. Maple sugar.
d. Malt sugar.
e. Corn sugar.
f. Cane sugar.
g. Honey.
h. Corn syrup.
i. Lactose (From milk).

Sugar supplies the energy, gas production, sweetness, and crust color in bread.

SHORTENING

Shortening refers to fats or oils used in baked goods. It produces a soft velvety crumb, termed "short." Fats or oils which impart this property are therefore known as shortenings.

Shortenings are edible fats or oils of vegetable or animal origin. Those which are fluid at ordinary temperatures are called oils, and those which are solid are called fats.

Shortenings when analyzed are found to be mixtures containing some of the following substances in various proportions:

1. Stearin, a hard natural fat of animal origin. Vegetable stearin is made by saturating vegetable oils with hydrogen gas. This is known as hydrogenated fat.
2. Palmitin, a fat secured from both animal and vegetable sources.
3. Olein, an oil secured from animal and vegetable sources.
4. Linolein, an oil present in cottonseed oil.

ANIMAL FATS

Lard is an excellent shortening. It is composed of a mixture of stearin, palmitin, and olein. There are many types of lard, depending from which part of the hog the fat is secured. Leaf lard is the highest grade, obtained from the fat surrounding the kidneys, and rendered at a high temperature.

Beef fats are separated into a hard fat known as oleo-stearin, and soft fats or oils known as oleo. The oleo oils are used in making oleomargarine, while the oleo-stearin is used in the preparation of compound shortenings.

Butter is the fat separated from milk or cream by churning. It is used mainly in cakes and pastries.

VEGETABLE OILS

Vegetable oils such as corn, cottonseed, and coconut are first refined and deodorized if they are to be used in bread making. While these oils can be used in bread making, they are more likely to become rancid than the solid fats.

HYDROGENATED VEGETABLE SHORTENING

When hydrogen gas is circulated through vegetable oils at high temperatures and under certain other controlled conditions, a gradual change takes place, resulting in a white solid fat. What happens is that two prin-

cipal constituents, olein and linolein, absorb the hydrogen and are converted into a solid fat, stearin. The longer the hydrogen is passed through the oil, and the more it is absorbed, the harder and whiter will the resulting fat become.

COMPOUND SHORTENING

As the name signifies, this group is made by blending vegetable oils with hard fats in proper proportion to obtain a product comparable to the consistency of lard. Thus cottonseed oil, corn oil, or other vegetable oils blended with vegetable or animal stearin form a compound shortening which is white, colorless, and of plastic consistency.

The animal stearin used in the manufacture of compounds is usually oleo-stearin, or the hard fat secured from tallow.

OLEOMARGARINE

This product is usually made of refined oleo oil, churned in with some pure butter, neutral lard, and milk. Sometimes vegetable oils are also used. Nut margarine contains cocoanut oil. Its shortening power is good.

Shortening used in bread improves its eating qualities, appearance, keeping qualities, and food value. Always keep shortening containers tightly covered, and store in a cool, dark, dry place.

MILK PRODUCTS

In bread making the following milk products are used:

Liquid Whole Milk	Dried ½ Skimmed Milk
Evaporated Whole Milk	Dried Skimmed Milk
Sweetened Condensed Whole Milk	Skimmed Evaporated Milk
Dried Whole Milk	Skimmed Condensed Sweetened Milk

BAKING POWDER

The addition of baking powder and water to a dough or batter liberates carbon dioxide gas when heated; another way of producing the same carbon dioxide is by the addition of yeast. The expansion of the dough, due to the liberation of the gas, produces baked products that are light, fluffy, crisp, and good to eat. By the use of baking powder this expansion is brought about quickly, whereas considerable time is required when yeast is used.

According to the definition and standard adopted by the United States Department of Agriculture, a baking powder is the leavening agent pro-

duced by the mixing of the acid reacting material and sodium bicarbonate, with or without starch or flour. It yields not less than 12% of available carbon dioxide.

The acid reacting materials in baking powder can be any one of the following:

(1) Tartaric acid or its acid salts
(2) Acid salts of phosphoric acid
(3) Compounds of aluminum
(4) Any combination in substantial proportions of the foregoing.

Although the substances named in this definition and standard for baking powder are ones ordinarily used in commercial baking powders, manufacturers are not prohibited from using other harmless substances that may be found suitable for some specific purpose. If any substance that is not included among those named in the definition is used in a baking powder, this fact should be plainly stated upon the label so that the purchaser will be fully informed.

There are 5 or perhaps 6 types of baking powder on the market today.

(1) Cream of tartar baking powder
(2) Monosodium phosphate baking powder
(3) Monocalcium phosphate baking powder or phosphate powder
(4) Phosphate alum baking powder
(5) Straight alum baking powder
(6) Calcium baking powder

As with other food products, it is desirable to having baking powders as free from impurities as possible. They must be within reasonable government tolerance with regard to lead, arsenic, zinc and tin.

CHEMICAL COMPOSITION

The approximate chemical composition of baking powders may be indicated by the following theoretical formulas for their manufacture. The examples shown below are calculated to give a theoretical total carbon dioxide strength of 14% for household baking powders, and 17% for commercial powder. The formulas given below are based on the chemically pure substances without the presence of moisture.

In these formulas it is assumed that 100 pounds of the acid reacting materials will neutralize respectively the following weights of bicarbonate of soda:

100 pounds cream of tartar will neutralize 44 pounds of sodium bicarbonate.

100 pounds tartaric acid will neutralize 116 pounds of sodium bicarbonate.

100 pounds monocalcium phosphate will neutralize 80 pounds of sodium bicarbonate.

100 pounds sodium aluminum sulphate will neutralize 104 pounds of sodium bicarbonate.

100 pounds sodium acid pyrophosphate will neutralize 75 pounds sodium bicarbonate.

While these values are theoretical, they will serve as a basis for commercial manufacture.

CREAM OF TARTAR AND TARTARIC ACID
BAKING POWDER

Sodium Bicarbonate	26.73 lb.
Corn Starch	22.40 lb.
Tartaric Acid	5.97 lb.
Potassium Bitartrate (Cream of Tartar)	44.9 lb.
Total	100 lb.

A baking powder which is quite generally used in the household, is a baking powder made up of cream of tartar (the acid salt mentioned in the first baking powder formula) and tartaric acid. These two substances are combined with 26.73 parts of baking soda and 22.4 parts of cornstarch to make up a baking powder of the same strength. The quantity of tartaric acid can be varied in a baking powder of this kind. As this substance is varied, it is also necessary to vary the cream of tartar and cornstarch content, for only a definite acidity is necessary to break up the baking soda, regardless of the type of acid used. Of course, since these amounts vary with the strength of acid used, it is necessary to use more or less and thus vary the quantity of starch.

CALCIUM ACID PHOSPHATE
BAKING POWDER

Sodium Bicarbonate	26.73 lb.
Corn Starch	39.84 lb.
Calcium Acid Phosphate (Mono)	33.43 lb.
Total	100 lb.

The monocalcium phosphate baking powder is the most common of the phosphate baking powders, and is often sold under the name of "imitation cream of tartar." When sold in this way it is toned down with cornstarch so that it will have the strength of cream of tartar.

In making up a combination of this salt with baking soda, 26.73 parts of baking soda, 33.43 parts of monocalcium phosphate and 39.84 parts of cornstarch, are used. The chemical reactions of the above baking powder are complicated, varying under different conditions. The chemical equa-

tion herewith presented probably represents what takes place under ordinary conditions.

$$3CaH_4(PO_4)_2 + 8NaHCO_3 = Ca_3(PO_4)_2 + 4Na_2HPO_4 + 8CO_2 + 8H_2O$$

PHOSPHATE ALUM BAKING POWDER or
COMBINATION BAKING POWDER

(S.A.S. PHOSPHATE)

Sodium Bicarbonate	26.73 lb.	26.73 lb.
Corn Starch	40.07 lb.	42.97 lb.
Monocalcium Phosphate	13.28 lb.	4.62 lb.
Sodium Aluminum Sulphite (Calcined)	19.92 lb.	25.68 lb.
Total	100 lb.	100 lb.

A combination baking powder results in a chemical reaction more complicated than with a straight powder. The 3 types of baking powder mentioned above probably constitute more than 90% of the baking powder produced in this country, the combination powders representing a large proportion of the total production. When a combination baking powder reacts, the monocalcium phosphate is activated first and (since this reaction takes place in the cold) there is an immediate leavening action. The sodium aluminum sulphate reaction requires heat and, therefore, will not act upon the baking soda until the dough is put into the oven.

CREAM OF TARTAR BAKING POWDER

Sodium Bicarbonate	26.73 lb.
Potassium Bitartrate	59.86 lb.
Corn Starch	13.41 lb.
Total	100 lb.

MONOSODIUM PHOSPHATE BAKING POWDER

Sodium Bicarbonate	26.73 lb.
Monosodium Phosphate (Anhydrous)	38.20 lb.
Corn Starch	35.07 lb.
Total	100 lb.

STRAIGHT ALUM BAKING POWDER

Sodium Bicarbonate	26.73 lb.
Sodium Aluminum Sulphate	25.68 lb.
Corn Starch	47.59 lb.
Total	100 lb.

The examples shown above are calculated to give a theoretical yield of carbon dioxide ranging from 12 to about 18%, from the reaction between sodium bicarbonate with an acid or acid salt. The purpose of adding corn starch is as a filler, to modify the amount of carbon dioxide produced to the same strength in all of the above examples, and to retard spoiling due to the presence of moisture in the powders and in the air.

CALCIUM BAKING POWDER

Recently there has been introduced a baking powder which is rather complicated in its makeup, but which seems to be very efficient in its action. It is made up of certain phosphates of the sodium type, monocalcium phosphate and calcium lactate. To this combination is added a definite amount of starch as a filler.

There are three definite reactions with this baking powder and, as each reaction takes place, some carbon dioxide gas is given off. The powder reacts in part in the cold, to some degree at a slightly elevated temperature, and finally, in the heat of the oven. It is believed that about 25% of the gas is liberated during the first two reactions and 75% in the final reaction.

One advantage of this baking powder is its water absorbing power when used in the cake mixture; i.e., a greater quantity of moisture must be added to liberate all the carbon dioxide from the powder. This may be due to the liberation of free lactic acid, with the formation of calcium phosphate. This reaction is probably reversible with a final reaction in which sodium lactate is produced along with calcium phosphate. There are probably a number of phosphates formed in addition to the lactate. Theoretically, at least, it can be said that this is a triply reacting baking powder since one reaction occurs in the cold, another at a slightly elevated temperature and a third in the heat of the oven.

The lactic acid, if formed and permitted to remain in the free state, would certainly have an opportunity to act on the gluten of the flour, thus causing the gluten to take on a greater quantity of moisture. It is probably this reaction which is responsible for the increased quantity of moisture required when this type of powder is used.

BAKING POWDER

Formula No. 1

Bicarbonate of Soda	35	lb.
Corn Starch	24	lb.
Sodium Aluminum Sulphate	29	lb.
Acid Calcium Phosphate	12	lb.
Albumen	2	lb.

BAKING POWDER

Formula No. 2

Bicarbonate of Soda	102	lb.
Corn Starch	86	lb.
Acid Sodium Phosphate	40	lb.
Acid Calcium Phosphate	45	lb.
Sodium Aluminum Sulphate	72	lb.
Albumen	½	lb.

BAKING POWDER

Formula No. 3

Sodium Bicarbonate	28 lb.
Corn Starch	41 lb.
Sodium Aluminum Sulphate	19 lb.
Acid Calcium Phosphate	12 lb.

Gas strength: 14½% CO_2

BAKING POWDER

Formula No. 4

Granulated Sodium Bicarbonate	28 lb.
Redried Corn Starch	37 lb.
Acid Calcium Phosphate	35 lb.

Gas strength: 14½%

CREAM OF TARTAR BAKING POWDER

Bicarbonate of Soda	27 lb.
Cream of Tartar	54 lb.
Corn Starch	14 lb.

BAKING POWDER—TARTAR SUBSTITUTE

Acid Sodium Phosphate	40½ lb.
Sodium Aluminum Sulphate	45 lb.
Corn Starch	64½ lb.

Or

Acid Sodium Phosphate	27 lb.
Sodium Aluminum Sulphate	30 lb.
Corn Starch	43 lb.

ALUM BAKING POWDER

Bicarbonate of Soda	28 lb.
Sodium Aluminum Sulphate	19 lb.
Acid Sodium Phosphate	20 lb.
Corn Starch	33 lb.

BAKING POWDER

Bicarbonate of Soda	35 lb.
Sodium Aluminum Sulphate	25 lb.
Calcium Acid Phosphate	13 lb.
Corn Starch	27 lb.

ALUM BAKING POWDER

Soda Alum	28 lb.
Bicarbonate of Soda	29 lb.
Corn Starch	43 lb.

Theoretical Gas: 15.4%

PHOSPHATE BAKING POWDER

Granular Calcium Acid Phosphate	56 lb.
Granular Bicarbonate of Soda	25½ lb.
Dried Corn Starch	18½ lb.
Theoretical Gas: 13¼%	

CREAM OF TARTAR AND TARTARIC ACID BAKING POWDER

Cream of Tartar	50 lb.
Tartaric Acid	3 lb.
Bicarbonate of Soda	26½ lb.
Corn Starch	20½ lb.
Theoretical Gas: 13¾%	

The cream of tartar and the soda should be in the granular form. The starch super-dried (otherwise use more starch).

PHOSPHATE AND ALUM BAKING POWDER

Soda Alum	22 lb.
Calcium Acid Phosphate	11 lb.
Bicarbonate of Soda	27 lb.
Corn Starch	40 lb.
Theoretical Gas: 14¼%	

CHEMICALS USED IN BAKING POWDERS

A. ALKALIES

Bicarbonate of soda is in general use, because it is easily neutralized, gives off a large amount of gas, is cheap, and is pure commercially.

Besides this, carbonate of magnesia (usually spoken of as "magnesia" ($MgCO_3$)), is used in small proportions. It produces about the same amount of gas per pound as sodium bicarbonate, but requires twice the amount of acid to neutralize it. It is extremely light, but since its bulk is about seven times as great as sodium bicarbonate, it increases the bulk of the baking powder. For the same reason, baking powder made with magnesia keeps better because the other ingredients are not as closely packed. Also, an excess of magnesia does not cause the product to turn yellow, as does a soda excess.

B. THE NEUTRAL SUBSTANCES OR FILLERS

Flour, corn starch, rice flour, are most commonly used.

Wheat flour, however, often contains larvae which develop worms, whereas, corn starch made by a chemical process is the best. Egg albumen is not of any real economic value, but is used as a filler to slow up the action of the powder. Starch and albumen thicken up the water so that a good body of foam is made, while any baking powder that contains

only a small amount of starch and no albumen will not foam up in this way.

C. ACIDS AND ACID SALTS

Tartrates } Hydric potassium tartrate—cream of tartar; Dihydric potassium tartrate—tartaric acid
Phosphates
Alums

Cream of tartar is most commonly used; its neutralizing strength is only 44; that is, 100 parts of cream of tartar neutralize 44 parts of sodium bicarbonate.

When cream of tartar baking powder is used, the oven must be very hot, so that the biscuit can be baked immediately after mixing, or failure is certain. The same thing is true of tartaric acid, but not to the same extent with any other acid ingredient in common use.

Tartaric acid has 2½ times the neutralizing strength of cream of tartar; it is an extremely active acid, and can be used with safety only in small proportions, except if it is used in granular form and with a large proportion of starch filler. It is a valuable ingredient, however, when used in a proportion of 2 or 3%, because it begins the leavening process the instant it is wet. Leavening is, therefore, more continuous and uniform.

The neutralizing strength of phosphates is about that of cream of tartar. The granular form is believed to possess better keeping qualities. Acid phosphate of soda (pyro sodium phosphate) is widely used, even if the cost is much higher than for calcium phosphate. A baking powder which contains no other acid salt except phosphates does not have good keeping qualities; therefore, the best way to use it is in connection with alum, whereby its properties are preserved until they are drawn out by the proper application of moisture and heat.

An alum is the double salt of aluminum and some other base. Only three of the alums, however, have been in use for baking powder: potash, ammonia and soda alum.

Potash alum, however, leaves a bitter taste; ammonia alum is very good, but there is a prejudice against the use of ammonia. Soda alum has no odor in baking, no unpleasant taste, produces the largest amount of gas and leaves the smallest amount of residue. It is the cheapest of all acid ingredients, has the best keeping quality and (since it is most commonly used with phosphates) preserves all the other ingredients. It takes up all the moisture, thus keeping the baking powder very dry.

Chemical action in baking powder occurs when the baking powder

comes in contact with moisture and heat. Soda should be used in the granular form, in pure phosphate and pure cream of tartar baking powders. The other ingredients, except the starch, can also be used to advantage in this form, because it has been discovered that the ingredients in granular form keep much better than if powdered.

CHAPTER IX

PREPARED PIE FILLINGS

The manufacturing of pie fillers is very closely related to that of making preserves, the essential difference being that starches are used for thickening purposes instead of pectin powder. In making pie fillers insufficient cooking is just as bad for the product as over-cooking. In the first instance the product will be too liquid and run out of the pie, while in the second instance the product will be too firm or rubbery and not pleasant to eat.

APPLE PIE FILLING

Evaporated Apples	50 lb.
Cane Sugar	50 lb.
Corn Syrup	150 lb.
Corn Starch	12 lb.
Tapioca Starch	4 lb.
Mixed Spices	9 oz.
Sodium Benzoate	4 oz.
Salt	8 oz.
Water	10 gal.

1. Soak fruit in water over night. The following morning soften the fruit with live steam and then put through the meat grinder.

2. Add ten gallons of water to the kettle and warm up just enough to take the chill out of the water. Now draw off three gallons for the corn starch and one gallon for the tapioca in separate mixing receptacles.

3. To the water left in the kettle add the steamed evaporated apples, start the steam. Then add cane sugar, mix around to dissolve same and add the corn syrup and salt. Now cook the contents of the kettle until the temperature reaches 214° F. At this point add the tapioca starch which has been made into a paste. The batch should be cooking not too vigorously, and should be stirred until the batch becomes transparent. Now practically shut off the steam and add slowly the cornstarch, previously made into a paste with the water. Cook up until heavy, and the cornstarch has become transparent.

4. Now add the mixed spices and a solution of the sodium benzoate. Transfer the pie filling to the cooling table, and when cooled down to about 130° F. pour into pails.

BLUEBERRY OR HUCKLEBERRY PIE FILLING

Formula No. 1

Fruit	100	lb.
Cane Sugar	75	lb.
Corn Syrup	75	lb.
Sodium Benzoate	4	oz.
Citric Acid	9	oz.
Powdered Pectin No. 80	1½	lb.

1. Mix the pectin powder with about 5 pounds of cane sugar.
2. Add 6 gallons of water to the kettle, bring to a boil, and then add the pectin mixture slowly with mixing. When completely dissolved, add the cane sugar, corn syrup, solution of sodium benzoate, and then the fruit. Bring the contents to a full boil, and when it sheets off the paddle, shut off steam. Now add the solution of citric acid, and mix in. Transfer the filling to the cooling table, and when cool run into pails.

Formula No. 2

Fruit	100 lb.
Cane Sugar	75 lb.
Corn Syrup	75 lb.
Cornstarch	6 lb.
Tapioca Starch	2 lb.
Sodium Benzoate	6 oz.
Citric Acid	9 oz.
Water	10 gal.

1. Add 10 gallons of water to kettle and warm up to remove the chill. Remove 8 gallons to a receptacle and mix in it the 8 pounds of starches.
2. To the 2 gallons left in the kettle add the sugar and the fruit, and start boiling, and while doing so add the corn syrup. Cook to 214° F. and then add the starch paste slowly, with stirring until the starches become transparent. Cook it all up to the proper heaviness. Shut off the steam, and then add the solution of sodium benzoate, stir around. Add the solution of citric acid and stir. Now transfer the filling to the cooling table, paddle around on the table to mix properly, and when cooled down run into pails.

CHERRY PIE FILLING

Formula No. 1

Fruit (Montmorency or Morello Cherries)	60	lb.
Cane Sugar	50	lb.
Corn Syrup	45	lb.
Cornstarch	8	lb.
Tapioca Starch	1	lb.
Shortening	3	lb.
Salt	8	oz.

Sodium Benzoate	3 oz.
Cherry Color (Dry)	¼ oz.
Water	6 gal.
Citric Acid	4 oz.

1. Place 6 gallons of water in kettle and warm up to remove the chill. Remove 1½ gallons and ½ gallon into receptacles, for the mixing of the corn and tapioca starch.

2. To the balance of water in the kettle add the sugar, turn on steam, then add the corn syrup, and while cooking add the shortening, salt, and then the fruit. Cook up to 214° F. Now add the tapioca starch paste, and cook to transparency. Then add the cornstarch paste and cook to proper transparency and heaviness. Shut off steam and add a solution of sodium benzoate, then citric acid. Paddle the contents around, transfer to cooling table, and when cooled off pour into pails.

Formula No. 2

Sour Cherries	150 lb.
Cane Sugar	130 lb.
Cornstarch	10 lb.
Tapioca Starch	6 lb.
Citric Acid	8 oz.
Water	12 gal.
Shortening	5 lb.

1. Add 12 gallons of water to kettle and warm up to remove the chill. Now draw off 3 gallons for the cornstarch and 2 gallons for the tapioca, and in separate receptacles make into starch pastes.

2. To the water left in the kettle add the cane sugar, and while cooking add the shortening and then the fruit. Boil the contents up to 214° F. Then add the tapioca starch paste and cook until it becomes transparent. Add the cornstarch paste, cook up to the proper heaviness. Shut off steam and add a solution of citric acid. Now transfer to the cooling table and then into pails.

FIG FILLING

Formula No. 1

Fig Paste	50 lb.
Dried Figs	50 lb.
Cane Sugar	100 lb.
Salt	8 oz.
Sodium Benzoate (Optional)	4 oz.
Water	10 gal.

1. Soak the figs and fig paste overnight in water. In the morning put the figs through the meat grinder.

2. Bring the 10 gallons of water in the kettle to a boil and add the cane sugar and then the fig paste. Dissolve the sodium benzoate and salt in a little water and also add to kettle. Bring the contents of the kettle up to 224° F. or to proper heaviness.

Formula No. 2

Fig Paste	50 lb.
Dried Figs	50 lb.
Cane Sugar	100 lb.
Corn Syrup	130 lb.
Salt	8 oz.
Sodium Benzoate (Optional)	5 oz.
Water	10 gal.

Make in same way as recommended above.

Formula No. 3

Dried Figs	100 lb.
Dried Apples	15 lb.
Cane Sugar	100 lb.
Corn Syrup	125 lb.
Sodium Benzoate	5 oz.
Salt	8 oz.
Water	15 gal.

1. Soak apples and figs overnight in separate containers, or the apples may be softened with live steam. Put both through the meat grinder.

2. To the water in the kettle add the cane sugar, start boiling and dissolve the sugar. Add the fig and apple paste, then the corn syrup. Dissolve the salt and sodium benzoate in a little water and add to the kettle. Boils the contents of the kettle to 224° F. or to the proper heaviness.

LEMON PIE FILLING

Formula No. 1

Powdered Lemon Juice	¾ lb.
Cane Sugar	110 lb.
Corn Syrup	165 lb.
Shortening	10 lb.
Cornstarch	32 lb.
Tapioca	10 lb.
Powdered Egg Yolk	3 lb.
Citric Acid	1 lb.
Salt	2 lb.
Lemon Oil (Dissolve in alcohol)	5 oz.
Sodium Benzoate	9 oz.
Egg Color Solution	5 oz.
Water	36 gal.

1. Measure out the 36 gallons of water into the kettle, remove chill. Into separate mixing receptacles, draw off 6 gallons for cornstarch, 3 gallons for tapioca starch, ½ gallon for egg powder.

2. Start cooking the balance of the water in the kettle and add the cane sugar, corn syrup, shortening, sodium benzoate, salt, and boil to 213°–214° F.

3. Whip up the tapioca starch with the 3 gallons of water into a paste and add to the kettle, stirring around with the paddle until the starch becomes jelled or transparent. This should take place in a minute or two.

4. Now whip up the cornstarch with the 6 gallons of water, add the color to it, and then add this to the kettle. Cook the batch until the starch jells or becomes transparent. Avoid too long cooking or the resulting pie filler will be too heavy. Paddle the mixture thoroughly after the cornstarch has been added. Shut off steam.

5. Whip up the egg powder until free from lumps with the ½ gallon of water drawn before. Add to kettle and quickly mix it in thoroughly. Now draw off about 3 gallons from the kettle and whip up with the lemon juice powder and also the citric acid dissolved in a little water. Then put it back into the kettle.

Transfer the batch onto the cooling table, and while paddling add the lemon flavor. When cooled down to about 130° F. fill the pails.

EGG COLOR SOLUTION

Tartrazine	9 oz.
Orange I	1 oz.
Water	2½ gal.

LEMON PIE FILLER

Formula No. 2

Powdered Lemon Juice	4 oz.
Cane Sugar	25 lb.
Corn Syrup	20 lb.
Shortening	2 lb.
Cornstarch	9 lb.
Tapioca	1 lb.
Powdered Egg Yolk	1 lb.
Citric Acid	2 oz.
Salt	2 oz.
Lemon Extract	2 oz.
Sodium Benzoate	2 oz.
Egg Color Solution	½ oz.
Water	52 lb.

Directions: Add to kettle.

Water	37 lb.
Cane Sugar	25 lb.
Corn Syrup	20 lb.
Shortening	2 lb.
Salt	2 oz.

and cook to 214° F.

Water	15 lb.
Tapioca Starch	1 lb.
Cornstarch	9 lb.

Whip up into paste and add with paddling to kettle. Cook until the starches gel, and drop in sheets from the paddle. Shut off the steam.

Whip up with ½ gallon of water the egg powder, lemon powder, citric acid, color, solium benzoate, and then add to the kettle. Mix around with the paddle, and then transfer to the cooling table. Add flavor to pie filler while on cooling table.

MINCE MEAT PIE FILLING

Water	8	gal.
Evaporated Apples	50	lb.
Brown Sugar	40	lb.
Corn Syrup	100	lb.
Beef Suet	15	lb.
Meat	60	lb.
Seedless Raisins	100	lb.
Spices	1½	lb.
Sodium Benzoate	9	oz.
Salt	1½	oz.
Wine	2	gal.
Alcohol	2	pt.

Soak the apples and raisins overnight. To the water in the kettle add the cane sugar, corn syrup, salt, sodium benzoate, and bring to a boil. Add the apples and raisins, which have been put through the grinder. Boil the contents to 214° F.

Cook meat until soft, then put through the meat grinder. Transfer to kettle above and cook to proper consistency. Shut off the steam, and now add spices, wine, and alcohol and mix with agitator.

The beef suet after being put through the grinder can be incorporated hot or cold into the batch. When the entire batch is in the cooling pan, or cooling down in the kettle, add the suet and continue agitating, or the beef suet can be added with the meat to the hot batch and thoroughly mixed in.

ORANGE-PINEAPPLE CAKE FILLING

Formula No. 1

Crushed Pineapple	48 (No. 10 tins)
Cane Sugar	350 lb.
Corn Syrup	40 lb.
Agar-Agar	2½ lb.
Sodium Benzoate	12 oz.
Salt	2½ lb.
Orange Color *	16 oz.
Orange Oil	8 oz.
Water	8 gal.

1. Soak the agar-agar in 8 gallons of water overnight.
2. Add the pineapple juice to the kettle, bring to a boil. Now add the sugar, corn syrup, salt, a solution of sodium benzoate, and also the color. While still boiling add the fruit and cook up to 216° F. Now add the agar-agar solution, putting it through a strainer first, and continue boiling to 221° F. Shut off the steam, transfer to cooling table, and when temperature is around 140° F. fill into pails.

*ORANGE COLOR SOLUTION

Orange I	4 oz.
Water	1 gal.

ORANGE-PINEAPPLE FILLING

Formula No. 2

Crushed Pineapple	24 (No. 10 tins)
Ground Orange Peel	90 lb.
Cane Sugar	400 lb.
Liquid Pectin (See Jelly chapter)	15 gal. (Or 5 gal. Douglas Pectin)
Citric Acid	8 oz.
Water	15 gal.

Add to kettle 15 gallons of water, bring to boil, then add the sugar, pineapple, and ground orange peel. Cook to 221° F. and add the pectin juice. Cook until temperature is 223° F. or until the batch sheets off the paddle. Shut off steam, add a solution of the citric acid, and then transfer to cooking table. A little orange color and sodium benzoate solution may be added, if desired.

PEACH AND APRICOT PIE FILLING

Evaporated Peaches or Apricots	75 lb.
Cane Sugar	75 lb.
Corn Syrup	75 lb.
Sodium Benzoate	5 oz.

Soak peaches or apricots overnight, cook up fruit, sugars, and sodium benzoate, very high, around 224° F.

RASPBERRY PIE FILLING

Raspberry Fruit	25 lb.
Raspberry Pulp	25 lb.
Cane Sugar	10 lb.
Corn Syrup	300 lb.
Red color	12 oz.
Powdered Pectin No. 80	3½ lb.
Water	15 gal.

1. Mix pectin with the 10 pounds of cane sugar.
2. Boil the 15 gallons of water and then add the pectin powder. When dissolved add the corn syrup, fruit, color, and cook to 221° F., or to a good sheet test.
3. Run hot filling into 30-pound pails, having in them 5 ounces of acid solution. True fruit flavor can be added if wished.

COLOR SOLUTION

Amaranth	4 oz.
Water	1 gal.

ACID SOLUTION

Tartaric Acid	4 lb.
Water	1 gal.

RASPBERRY-PEACH FILLING

This filling is made with the addition of 30 pounds of evaporated peaches to the above formula.

The peaches should be soaked overnight, and in the morning put through the grinder.

BAKERS' STABILIZER C* STRAWBERRY PIE

WITHOUT STARCH

Water	1 gal.
Sugar	5 to 8 lb.
Bakers' Stabilizer C	6 oz.
Salt	2 oz.

Dry mix the stabilizer and sugar. Add to the water. Bring to a boil and boil from 2 to 3 minutes. Remove from fire. Let cool slightly and add frozen strawberries. One pound of strawberries per 1 pound of gel is a proportion frequently used. Variations in the gel may be obtained by using different amounts of stabilizer.

WITH STARCH

Water	1 gal.
Sugar	5 to 8 lb.
Bakers' Stabilizer C	3½ oz.
Salt	2 oz.

* Stein, Hall & Company, Inc., New York City.

Dry mix the stabilizer and sugar. Add to the water. Bring to a boil and boil from 2 to 3 minutes. Add to the boiling solution a suspension of 11 ounces of cornstarch in 1 quart of water. Bring to a boil.

Remove from fire, let cool slightly, and add frozen strawberries. One pound of strawberries per 1 pound of gel is a proportion frequently used. Variations in the gel may be obtained by using different amounts of starch and stabilizer. Thus, when 1 pound of starch is used, the stabilizer should be reduced to 2 ounces.

A few drops of red fruit color may be used in this mixture. The amount of sugar to be used varies, depending on the desired sweetness of the filling.

BAKERS' STABILIZER C* BASE FOR FRUIT PIES

WITHOUT STARCH

Mix 8 ounces of Bakers' Stabilizer C with 10 pounds of sugar and add, with stirring, to 1 gallon of water. Bring to a boil and continue boiling for 2 to 3 minutes. Work in the berries with boiling syrup, allow to cool, and deposit in pie.

The amount of stabilizer necessary varies with different kinds of pies and with different formulas. Each case has to be taken separately. The above is a typical formula with berries, using Bakers' Stabilizer C.

WITH STARCH OR TAPIOCA

Sugar	10 lb.
Water	1 gal.
Bakers' Stabilizer C	3 oz.

Bring to a boil and continue boiling for 2 to 3 minutes. Mix 1½ pounds of cornstarch (or 1 pound of cornstarch and ½ pound of tapioca) with 2 quarts of water. Add to the above and cook until clear. Remove from fire and let cool; then work in the fruit.

BUTTERSCOTCH PIE FILLER POWDER

Formula No. 1

Light Brown Sugar	22 oz.
Skimmed Milk Powder	3½ oz.
Powdered Egg Yolk	1 oz.
Roasted Powdered Skimmed Milk	3½ oz.
Corn Starch	5½ oz.
Salt	¼ oz.
Water	4½ pt.

* Stein, Hall & Company, Inc., New York City.

Formula No. 2

Light Brown Sugar	23½ oz.
Skimmed Milk Powder	6 oz.
Roasted Powdered Skimmed Milk	2½ oz.
Corn Starch	5 oz.
Salt	¼ oz.
Water	4½ pt.

Butterscotch pie filling can be made by bringing to a boil 2½ pints of water, then stirring in the above ingredients into the balance of 2 pints of water to a smooth mixture, adding this to the boiling water, and cooking until thick and glossy (185–190° F.). For better flavor add 2 oz. of butter. Add vanilla or maple flavor.

LEMON PIE FILLER POWDER

Granulated Sugar	28 oz.
Powdered Whole Eggs	1 oz.
Powdered Lemon Juice	2½ oz.
Tapioca Starch	6½ oz.
Citric Acid	1/10 oz.
Salt	¼ oz.
Water	4½ pt.

The lemon pie filler may be modified considerably to reduce the cost. Less lemon juice can be used and lemon flavor substituted, etc.

The above when cooked properly (as suggested for butterscotch pie powder filling) results in a good product. The addition of 2 oz. of butter will make a richer filling.

CHOCOLATE PIE FILLERS

Formula No. 1

Granulated Sugar	20 oz.
Dried Whole Milk	5 oz.
Powdered Egg Yolk	1¼ oz.
Cocoa Powder	4 oz.
Corn Starch	5½ oz.
Salt	¼ oz.
Water or Milk	5 pt.

Formula No. 2

Granulated Sugar	20 oz.
Powdered Skimmed Milk	3½ oz.
Powdered Sugar	2½ oz.
Cocoa Powder	3½ oz.
Salt	¼ oz.
Water or Milk	5 pt.

Chocolate pie filling can be made by bringing 3 pints of water to a boil. Now mix into a smooth paste the ingredients with the balance of 2 pints

of water or milk. Then add this to the boiling water, cook until thick and glossy (185–190° F.). Add 2 oz. of butter for better quality.

GELATIN ICING POWDER

Gelatin	10 lb.
XXXX Sugar	10 lb.
Gum Arabic	2 lb.

One ounce of this powder, added to ½ pint hot water, then stirred well, can be used instead of egg whites. It can be colored and flavored.

IMITATION EGG POWDER COMPOUND

Powdered Egg White	2 lb.
Powdered Egg Yolk	1 lb.
Gum Karaya	3 lb.
Potato Flour	4 lb.

LEMON POWDER FOR PIE FILLINGS

Cornstarch	75 lb.
Citric Acid	5 lb.
Powdered Sugar	20 lb.
Lemon Oil	6 oz.

VANILLA POWDER

Powdered Mexican Vanilla Bean	50 lb.
Granulated Sugar	50 lb.
Oil Bitter Almond	½ oz.

PIE FILLING POWDER BASE FOR ALL FLAVORS

Cornstarch	45 lb.
Tapioca Starch	15 lb.
Citric Acid	1 lb.
Gum Karaya	½ lb.
Salt	1 lb.
True Fruit Flavor	To Suit
Imitation Fruit Flavor	To Suit
Certified Food Color	To Suit

This recipe when properly mixed with sugar, will make the filling for pies. Cherry, strawberry, raspberry flavors may be used. For lemon, a small percentage of powdered egg yolk will improve the taste of the product.

Directions:—One pound of the above formula is dispersed in 1 quart of warm water. Then add this to a hot solution of 3 pounds of sugar in 3 quarts of water. Boil, and remove from fire as soon as it thickens.

CHAPTER X

SPECIALTY FOODS, BAKERS' PRODUCTS, ICINGS, FUDGES, FONDANTS, FOOD COLORS, MARSHMALLOWS, MERINGUES, EMULSIONS, FLAVOR COMPOUNDS, FRUIT SYRUPS, BEVERAGES, FOUNTAIN SUPPLIES, CANDY, SYRUP TABLES.

COOKIES

In order to develop formulas for crunchy cookies, large proportions of sugar should be used. When *MORE SUGAR THAN FLOUR* is used, it is advisable also to pay particular attention to the flour, in order to be sure to use one strong enough to carry the sugar. If a weak flour is used, the cookies fall and do not have proper thickness or shape.

When making crisp cookies, very little milk or water should be incorporated in the batters in order to secure proper spread. Instead of using extra liquids, spread should be obtained in other ways. Coarse granules of sugar produce more spread than fine particles of powdered sugar. If part of the sugar is added with the flour, it causes more spread and more of a macaroon top effect than if all of the sugar is creamed with the shortening. Dissolving the sugar in the liquids makes for a uniform spread and smooth top.

In order to produce a macaroon top on cookies, use a stiff dough containing high proportions of sugar and leavening agents. Part of the sugar (preferably coarse granulated) should be added just before finishing the mixing. Also, if desired, put extra granulated sugar on top of the cookies before baking. Use plenty of steam in the oven.

Macaroon top cookies are very attractive when the tops of the raised "peaks" have a rich golden brown color. This appealing quality is produced in cookies made with formulas which specify the proper proportion of Nulomoline.

USING DIFFERENT KINDS OF SUGAR:

The spread of cookies is altered by incorporating the sugars used in different ways or by balancing one type of sugar with another. If a smoother crust is desired than that secured with coarse granulated sugar

in the dough, finer sugars should be used. Fine granulated and powdered sugars impart a smoother appearance.

When a smooth crust and a richer, more appetizing bloom is desired, a larger part of the total sugar should be Nulomoline. Its maximum levulose content not only imparts a flashier color without forced baking, but also produces greater spread and spring with a smooth instead of a cracked crust.

Use about 1 pound of Nulomoline for every 10 pounds of sugar in doughs for crisp cookies, in order to secure better spread. The Nulomoline also imparts, (without forced baking) a rich, attractive, non-fading bloom. It properly distributes and holds very small percentages of moisture in crisp cookies and, thereby, eliminates checking and reduces losses due to breakage.

Two other qualities secured with Nulomoline are in contrast to those obtained with granulated sugar. Nulomoline attracts and holds moisture instead of throwing it off. Consequently, the presence of Nulomoline in the cookies aids in retaining and evenly distributing moisture which otherwise would escape from the cookies upon their removal from the oven. As a result, losses from checking are materially reduced and there is less strain and contraction of the cookies while cooling.

Moreover, while cookies which contain very high proportions of sugar, tend to grain, become crumbly and lose their "snap," the levulose content of Nulomoline stops graining, and cookies made with it stay fresh longer.

INTENSIFYING FLAVORS WITH SUGAR:

Primarily, sugar acts as a sweetening agent. In addition, it is valuable in bringing out or intensifying other flavors; this is particularly true with mild flavors such as banana.

Experiments conducted in The Nulomoline Testing Bakery have shown that, although a given amount of Nulco Meloban produces a mild banana flavor, it becomes much more pronounced when extra sugar is used. In fact, when Nulco Meloban is incorporated in sweet cookies, it is strong enough to carry through such ingredients as cocoa and produces very pleasing rich combinations.

KEEPING COCONUT MACAROONS SOFT AND CHEWY:

Although it may seem that there are many different kinds of coconut macaroons, actually almost all are alike in several respects, differing mostly in appearance and eating qualities.

The simplest macaroons are modified confections—compact, flattened balls of sweetened coconut, slightly toasted on the top and bottom. These are the soft, chewy dough ball type of macaroons, usually made by spe-

cialty concerns and biscuit bakers. They are distributed in such places as the bakery and candy departments of retail grocery and 5-and-10¢ stores.

In contrast to the compact dough ball type of macaroons are those of the meringue type, which are considerably lighter and fluffier. These are not simply toasted on the surface but are thoroughly baked all the way through. These chewy macaroons are not quite as soft as the dough ball variety, but are firmer because of the extra baking and "set." This type is made mostly by retail bakers and by soft cake and biscuit bakers. In between the dough ball and meringue types are many varieties, but practically all are modifications of these two. The similarities of all varieties are apparent when they are considered from the point of their structure, rather than their appearance.

All coconut macaroons consist of particles of coconut, surrounded by syrup which holds the coconut together. (This is all there is to the dough ball type.) However, if part of the sugar is dissolved in egg whites, instead of solely in water, the meringue type is produced instead of the dough ball type. The egg whites entrap air during mixing and then, during baking, swell and coagulate or set. This explains why the meringue type requires thorough baking, whereas only toasting is needed for the dough ball type, which contains no ingredients that set (even if heated to high temperatures).

All other varieties of coconut macaroons are simply modifications of the two distinct types just mentioned. Sometimes starches or flour are mixed into either one or the other types; also, occasionally, leavening agents are added. The quantity of eggs used in the meringue type varies considerably from only 5 pounds in a 100 pound batch to as much as 20 pounds and more; with small amounts of eggs, flour and baking powder usually are used. Of course, fresh or frozen egg whites may be replaced by equivalent amounts of dried whites (egg albumen).

One variety is made by incorporating a small proportion of fat into a modified meringue type containing flour and baking powder. This produces an almond macaroon top appearance—smooth and glossy with shallow "cracks."

BALANCING THE SYRUP:

As pointed out in a preceding paragraph, the syrup in a macaroon serves to surround and hold the coconut particles together. Moreover, it functions to sweeten the whole macaroon and to impregnate the coconut so as to soften and sweeten it. Thus, it can be readily understood why the syrup controls the quality of the finished macaroon. For retained freshness and chewiness, the syrup must not dry out, crystallize or harden,

but should hold moisture and remain soft. For these properties—moisture retention and crystal control—the levulose contained in Nulomoline is most advantageous.

Laboratory and shop tests show that macaroons which contain from 5 to 20 pounds of Nulomoline in each 100 pound batch have long-lasting, soft, chewy eating-qualities.

The Nulomoline also imparts a rich, golden crust color and the macaroons are more attractive and appealing.

SELECTING AND HANDLING THE FLOUR:

When developing formulas for fruit or other specialty cookies, a flour should be selected which will carry the fruit combination and produce the cookie shape desired. The formula should not be limited by a flour which necessitates formula juggling in order to get from it an acceptable shape. If, from the many types of flours available, satisfactory appearance is not obtained on the first mixing, the mixing time can be lengthened or shortened. Increased mixing usually tightens the dough, allowing the flour to carry the fruit and preventing the cookies from spreading too much during baking. Added absorption increases the spread; a tighter dough retards spread.

REVISING STANDARD FORMULAS:

For improved eating qualities, some of the standard formulas can be revised as follows:

(1) Select a cereal other than wheat flour—e.g., oatmeal. (2) Use at least part of the shortening as butter. (3) Use part of the total sugary materials as Grandma's Old-Fashioned Molasses—a delicious, flavorful sweetener. (4) Use natural flavor-carrying materials, such as ground raisins, figs, chopped nuts and Nulco Meloban. They add extra taste appeal and are low in cost.

Combinations of these materials produce unusually good eating qualities, especially if high percentages of sugars are included to impart crunchiness. Doughs for crisp, crunchy cookies should be stiff to secure a rough, home-like finish when run on a wire-cut cookie depositing machine. When the oatmeal is in fine splinters, the dough feeds through the die and cuts off without dragging on the wire. If the oatmeal is of large flakes, they can be made finer by mixing them by themselves until broken up into small particles.

HANDLING SOFT AND STIFF DOUGHS:

The consistency of almost all doughs must be kept within very narrow limits for the sheeter, bar press, shortbread and all other machines except

the wire-cut. Practically all doughs developed specifically for other machines, with little modification, can be used on a wire-cut machine. This is in contrast to the fact that many wire-cut cookies cannot be made on any of the other machines.

Both soft doughs (such as those for vanilla wafers and macaroons) and stiff doughs (such as those for rough-topped sugar or short-bread cookies) can be run on a wire-cut machine. For this reason, many special cookies can be developed for production with a wire-cut machine.

MAKING MANY VARIETIES ON THE WIRE-CUT MACHINE:

Although formulas for molasses-honey hard cake cookies made on a sheeter are somewhat similar to those for honey jumbles (both contain high proportions of Nulomoline, sugary materials and low proportions of shortening), the doughs for honey jumbles are softer. Honey jumbles are usually run on a wire-cut machine, are not baked hard and are kept soft by using Nulomoline for a large part of the sugary materials. The wire-cut machine is used also for a wide variety of cookies, containing great variations in sugar, shortening and flavor-carrying ingredients, and for flour-confections such as almond and coconut macaroons. Moreover, the wire-cut machine and depositor are used for handling soft doughs or batters, such as those for vanilla wafers and soft drop cake cookies.

Competitive conditions force many bakers to emphasize one or more of three phases of production. Band oven installations for cookie production are driving selling prices down—which tends to cause quality to be sacrificed for low production costs on many items. Without such equipment, bakers should not attempt to make similar varieties. Rather, they should make better cookies, by paying particular attention to all workmanship that enhances appearance or by using unusual ingredients to improve eating qualities.

Some materials not normally used in cookies which are made on other machines are particularly suitable for use with a wire-cut machine.

MAKING SOFT "DROP CAKE" COOKIES:

In between soft layer cakes and common cookies is a group of products which are often called "drop cakes" or "soft cookies." These are not exactly soft cakes or dry cookies but have a few qualities of both. Soft cookies are particularly suited for warm, humid sections of the country where it is difficult to keep cookies crisp. Moreover, they are popular everywhere if prevented from drying out and becoming crumbly.

Soft cookies should take color quickly in the oven without forced baking that dries out too much moisture. Also, they should retain their mois-

ture after baking to keep them in fresh eating condition. For these purposes the use of Nulomoline is beneficial.

From $1\frac{1}{2}$ to 3 pounds of Nulomoline to every 10 pounds of sugar quickly produces a rich, ruddy bloom that prevents excessive drying in the oven and gives cookies an appetizing appearance. It attracts and holds moisture and keeps soft cookies in good condition for a long time.

Soft layer cakes are baked in pans which have sides that hold the soft doughs in shape (both during baking and until most of the eggs in the dough sets) and are able to continue to hold the shape and lightness of the moist finished product.

Cookies are baked in pans which *have no sides.* The formed pieces of dough are stiff enough in consistency to retain their shape during baking and are dry enough after baking to hold their shape without having a high egg content.

The doughs for soft drop cookies are softer than for common cookies but stiffer than for layer cakes. The total egg content plus milk or water usually equals less than three-quarters, but more than one-half, of the weight of the flour. Cookies are stiff enough to hold their shape before and during baking without being dropped on pans with sides, but are so soft and moist before and after baking that they require considerable gas to retain lightness and large size.

The doughs or batters for drop cakes or soft cookies should be built up carefully during creaming and mixing until light, fluffy and strong. The doughs or batters should be mixed carefully similar to those for cakes made according to the usual creamed sugar-shortening-eggs method. The creamed portion and the final batter should not be curdled or broken down as they are for so many ordinary cookie doughs.

When mixing is done carefully, the final grain and texture is uniform and not too many of the cell walls are broken down. When batches are curdled, the cookies are more crumbly. The doughs or batters are usually dropped on pans greased with shortening and dusted with flour or on pans with a depression for each cookie.

Information about these soft cookies or drop cakes is useful in making many profitable items that are quite popular. For example, several varieties of soft cookies or drop cakes can be used for making five cent varieties: make gold, chocolate or banana round drop cakes, about three to four inches in diameter and about one-half inch thick. Top these big, soft cookies with marshmallow and enrobe the marshmallow in a quick-setting coconut fat icing—or sprinkle with coconut, decorettes, etc. As an alternative, two cookies can be sandwiched with marshmallow or imitation whipped cream. Another group of varieties may be made by baking

the dough into finger forms (about 4½ inches long, 1½ inches wide and ½ inch thick) and then topping or sandwiching.

MAKING VANILLA WAFERS:

Vanilla wafers constitute a group of cookies which have certain unique and well-defined characteristics. They have a typical, light, fluffy, tender, pinhole grain—which is in contrast to the flat grain of hard sweets and common cookies. Wafers are made from carefully creamed, soft batters which usually contain a considerable quantity of eggs and which are deposited in a wire-cut machine. These soft batters for wafers are in contrast to the curdled stiff doughs which contain little or no eggs and which are used in making other cookies. Vanilla wafers are somewhat similar to soft drop cake cookies, except that the wafers are baked out until quite dry, whereas the soft drop cake cookies are quite moist after baking. The formulas for vanilla wafers usually specify about 35 pounds of shortening (preferably part butter), 60 pounds of sugar, 5 pounds of Nulomoline, 10 pounds of eggs and sufficient leavening for every 100 pounds of flour.

The distinctly unique grain and texture and tender eating qualities of vanilla wafers have been popular for a long time. Other cookies having similar grain and texture but different flavor and color (e.g., molasses, chocolate and lemon) also can be made.

Changes in flavor and color stimulate sales. The chocolate-molasses base specified in this formula also improves the appearance and eating qualities of base-cake cookies for marshmallow topped varieties.

MAKING TENDER MELLOW BASE-CAKES:

Vanilla wafers, as made on a wire-cut machine or depositor, are often modified and used as base-cake cookies for marshmallow topped varieties. These modified vanilla wafers for base-cakes, usually contain less shortening, little or no eggs, but more Nulomoline. In base-cakes made on a wire-cut machine, use about 10 pounds of Nulomoline to every 100 pounds of a combination of sugar and Nulomoline for summer or humid weather; for winter and dry climates use about 30 pounds of Nulomoline.

Base-cakes for cookies to be topped with marshmallow are also made on the rotary machine and on the sheeter. The rotary machine reduces production costs a great deal, especially when used along with a band oven. Base-cakes with a higher proportion of shortening may be made with a rotary, rather than with a wire-cut or sheeter, without increasing total cost. Moreover, the pieces made on a rotary machine are more uniform in shape. Uniformly shaped base-cake cookies are also made on the sheeter.

PRODUCING A POROUS GRAIN:

In making base-cakes on a rotary machine or sheeter, the formula is adjusted to specify a considerable proportion of the total leavening agents as ammonia; this produces a quick spring without too much spread. It also makes the bottoms and insides more porous so that the cakes quickly absorb moisture from the marshmallow, becoming mellow, soft and tender.

SECURING SOFTNESS:

Base-cakes made on a rotary machine or sheeter should specify more Nulomoline than used in shortbread cookies or in common cookies, so that the baked pieces will rapidly become mellow before and after being topped with marshmallow. After baking base-cakes, they should be stored in a humid room (relative humidity about 65%) until they become somewhat softened (about 2 or 3 days), before topping with marshmallow. The large amount of Nulomoline in rotary and sheeter machine base-cakes (10 to 30% of the total sugar) is the same as that specified for wire-cut base-cakes.

HOLDING MOISTURE IN SOFT COOKIES:

Nulomoline is a valuable ingredient in all soft cookies because it attracts and holds moisture, thereby, checking drying. For an explanation of what happens during the mixing and baking of soft cookies, reference should be made to the preceding comments concerning chewy cookies. Soft cookies differ from chewy cookies in that more water is used in making soft cookies, which should be retained during baking and merchandising. Nulomoline aids in keeping them moist.

USING SUGAR TO DEVELOP CRISP, MACAROON TOP COOKIES:

Crisp cookies are not those which have been dried out during or after baking, but rather are cookies which have crunchy, enjoyable eating qualities imparted by the ingredients used. Some crisp cookie formulas are limited in application because they specify *less sugar than flour,* in proportions insufficient to impart crunchiness. These low sugar content formulas were perhaps developed in disregard of the fact that true cookies are *sweet* cakes; or they were developed in an effort to use soft flours, which do not require large proportions of enriching ingredients for tenderness, but which cannot carry enough sugar for crispness.

DEFINING COOKIES:

The dictionary definition states that cookies are small sweet cakes, sometimes spiced. This definition embraces a wide variety of bakery products—crackers, biscuits, common cookies, soft drop-cake cookies, flour-confections, cup cakes and other small cakes. The following facts concerning the development and use of formulas apply to all of these COOKIE products.

When the formulas for all cookie products are included in a single group, they seem to specify almost all conceivable proportions of ingredients. In fact, by mixing and molding materials by hand, great variations in the proportions of flours, sugars, fats, eggs, milk and flavor-carrying ingredients can be effected and the final doughs or batters can be baked into products having an attractive appearance and pleasant eating qualities.

However, when the proportions of ingredients are kept within certain narrow limits, they produce definite characteristics. When the structure of the cookies is formed chiefly by eggs (e.g., sponge drops and lady-fingers) they may be called sponge cookies. Cookies which contain a large proportion of fat (e.g., pound cake) may be termed shortbreads. Variety cookies (e.g., vanilla wafers and sugar cookies) have small amounts of fat and eggs; they are somewhat analagous to batter cakes. Moreover, machines have been built which not only duplicate hand operations but also make it possible to produce economically certain new characteristics.

Each type of cookie is mixed in a manner similar to the way in which various types of cakes are mixed. Sponge cookies (among which are lady fingers, almond macaroons and meringue kisses) are made by whipping eggs and then folding in the dry ingredients. Shortbreads are mixed by creaming fat, sugar and eggs and then adding the liquid and dry materials. Shortbreads can be mixed by incorporating the fat and flour and then adding the eggs and sugar. Variety cookies are made by creaming the sugar, shortening, eggs, and adding the liquids and flour; this is similar to the way shortbreads are made. The methods are analagous to the methods used in making baking powder batter cakes.

Cookie doughs are going through two stages of development. First, doughs that formerly were made up by hand-rolling or cutting or by hand-bagging, are being run on machines built to imitate hand work. Second, these doughs are being modified somewhat for better running or to improve eating qualities.

CLASSIFYING COOKIES BY MACHINES AND PROPORTIONS OF INGREDIENTS:

The foregoing indicates that, although the term *"COOKIES"* covers a wide variety of bakery products, all of these may be classified into at least three distinctly different groups, according to: (1) the machine used in making them, (2) the proportions of ingredients used, and (3) the finished characteristics.

The particular machine used limits to some extent the varieties of cookies which can be turned out. The rotary machine limits production to cookies of the shortbread type, the bar press to bar cookies, the sheeter to crackers, biscuits, hard cookies and similar products made from dry doughs which can be sheeted. Although each of these machines produces a large variety of products in each distinct class, none of the machines will produce to advantage the products which the others are particularly suited to turn out. In contrast, the wire-cut machine will handle almost any kind of doughs and make almost all varieties of cookies, except biscuits, crackers and embossed pieces. However, the wire-cut machine is particularly suited to batter doughs for vanilla wafers and to short, stiff doughs for snaps and similar varieties.

When cookie products are classified according to the proportions of ingredients used, they fall into certain distinctly different groups, and most of the varieties in each class are made to the best advantage on a certain machine. For example, the term "cracker" usually refers to all lean dry products which are made, almost without exception, on a sheeter.

DESCRIBING CRACKERS:

Crackers, essentially, are mixtures of flour and water with little or no sugar and eggs, and with more or less shortening. When flour is mixed with enough water to form a stiff dough—100 pounds of flour plus 30 pounds of water—and then rolled into thin sheets and baked, water or matzoh crackers are produced. When the dough is fermented for about 18 hours, with about four ounces of yeast and ½ pound of Xpando or malt, seasoned with about 1 pound of salt, caused to spring and color with about ½ pound of soda and tenderized and flaked with about 10 pounds of shortening, soda crackers are produced. For cheese crackers about 30 pounds of cheese are incorporated into a soda cracker dough. When a soda cracker dough is given a shorter fermentation period and extra fat is rolled in, cream crackers are made. When the basic dough is very stiff, not fermented, and no leavening is used, and about ½ pound of salt and 5 pounds of fat are worked in, pilot crackers result. When the basic dough is softer, including about 1½ pounds of soda and acid leaven-

ing, about 15 pounds of shortening and about 5 pounds of sugar, lunch-acid crackers are the product. By incorporating a little more or less sugar, shortening and milk, other varieties of acid crackers are made. When acid crackers are sprayed with coconut fat, butter crackers are produced. Butter thins are made with about 100 pounds of flour, 15 pounds of shortening, 3 pounds of sugar and with about 10 pounds of Nulomoline for rich crust color and prevention of checking and breaking.

When about one quarter of the white flour in a plain dough is replaced with whole wheat flour, the flavor improved with about 40 pounds of a combination of molasses, Nulomoline and sugar, and the dough shortened with about 15 pounds of fat and aerated with about 1 pound of soda and ½ pound of ammonia, graham crackers are produced.

USING THE SHEETER MACHINE:

The sheeter machine is used not only for crackers, but also for other varieties of cookie products made from dry doughs which can be rolled out and then cut and embossed—hard or semi-hard sweets, hard cookies, embossed items, and hard cakes. These varieties contain considerably more sugar and shortening than most crackers. The lean varieties (such as hard sweets which contain only about 10 pounds of shortening, 2½ pounds of Nulomoline and 30 pounds of sugar to about 100 pounds of flour) and especially those made from doughs which receive and hold an impression, are often called biscuits. The richer varieties (such as the typical, large, American hard types which contain about 15 pounds of shortening, 5 pounds of Nulomoline and about 50 pounds of sugar to 100 pounds of flour) are classified as common cookies. Those with extra sugar are called snaps. The hard-cake cookies, or honey molasses types, are made on a sheeter by using large proportions (75 pounds) of sugary materials—sugar, Nulomoline, molasses or honey—and low proportions (5 pounds) of shortening.

MAKING FIG AND MOLASSES-COCONUT BARS:

Some sheeter machines have a bar press attachment which is used in making varieties such as molasses-coconut bars and fig bars. Molasses-coconut bars contain about 15 pounds of shortening, 30 pounds of Nulomoline and about 50 pounds of other sugary materials (including molasses) for each 100 pounds of flour. Bar cookies are made also on some wire-cut machines which can handle stiff doughs. The jackets for fig bars usually contain about 15 pounds of shortening, 10 pounds of Nulomoline and about 40 pounds of sugar. Bar press machines, separate from the sheeter, for fig bars are available.

USING THE ROTARY SHORTBREAD COOKIE MACHINE:

When high proportions of shortening (from 30 to 50 pounds) and from 35 to 65 pounds of sugar for each 100 pounds of flour are incorporated in doughs, they become too tender to roll out and sheet on a machine. These shortbread doughs must be pushed through a wire-cut machine die or, preferably, handled on rotary machines which are designed especially for handling shortbread varieties.

DE LUXE GRAHAM CRACKERS

(Rich Brown Crust and Crumb, Good Spring, Flaky, Crispy and Fine Flavor, Basic Formula for Sheeter.)

* Sugar	15 lb.
Grandma's Old-Fashioned Molasses	15 lb.
Nulomoline	5 lb.
Salt	1¼ lb.
Water	20 lb.
** Flour—Clear	80 lb.
Whole Wheat	20 lb.
Soda	1 lb.
Ammonia	½ lb.
Shortening	15 lb.

* Other proportions of Grandma's Molasses, sugar and Nulomoline can be used: (1) a greater total (up to 55 pounds), or (2) less molasses and more sugar, to make a total of 35 pounds. Increased amounts of Grandma's Molasses overcome the satiating taste of dark flours and produce a richer brown crust color.

** Other proportions of white and dark flours can be used, such as, 5 bran, 5 cracked wheat, 20 whole wheat and 70 clear.

Heat the sugar, Grandma's Molasses, Nulomoline, salt and water to about 180 degrees F.; have the temperature of this syrup such that the heat will warm the final dough to 120 to 130 degrees.

Meanwhile, separately blend the flours and leavening agents.

Combine the hot syrup with the flour blend and the shortening. Mix the dough smooth and run it while warm.

MOLASSES BRITTLE-ETTES

(Ginger Snaps with Good Crack, Medium Molasses Content, for Sheeter and Wire-Cut Machine or Hand-Made.)

Small Batch		Large Batch
4 lb.	Sugar (fine granulated)	40 lb.
2 lb.	Shortening	20 lb.
½ lb.	Milk (Solid basis)	5 lb.
1½ oz.	Salt	1 lb.
2½ oz.	Ginger	1½ lb.
½ oz.	Nulomoline	5 lb.
4½ lb.	Grandma's Molasses	45 lb.

Small Batch		Large Batch
¾ lb.	Water	8 lb.
2½ oz.	Soda	1½ lb.
10 lb.	Flour	100 lb.

Cream the sugar, shortening, dry milk, salt and ginger.

Add the Grandma's Old-Fashioned Molasses, Nulomoline and water.

Separately blend the soda and flour. Add this blend to the creamed mixture and mix smooth.

The basic formula may be used either for sheeter, wire-cut or hand-rolled and cut cookies. By using different amounts of water, change the consistency of the dough to fit the procedure desired.

GOLDEN FIG BAR JACKET

(Basic Dough. To Be Filled with Fig Jam, For Bar Press Machine.)

Sugar (powdered)	40 lb.
Salt	½ lb.
Shortening (or part butter)	20 lb.
Nulomoline	10 lb.
Flavor	As desired
Eggs (whole)	12 lb.
Soda	½ lb.
Ammonia	¼ lb.
Milk (liquid basis)	18 lb.
Flour	100 lb.

Cream the sugar, salt, fat, Nulomoline and flavor. Gradually add the eggs.

Dissolve the soda and the ammonia in the milk and add it along with the flour. Mix smooth.

For a leaner dough, replace part or all of the eggs with milk; replace part or all of the milk with water; reduce the shortening.

GENERAL FIG BAR FILLING

(Basic Formula)

Figs (ground)	500 lb.
Water	Sufficient to Soften the Figs
Sugar (fine granulated)	200 lb.
Corn syrup (glucose)	100 lb.
Nulomoline	200 lb.
Salt	2–3 lb.
Flavor	As desired

Soak the figs with sufficient water and long enough to soften them. Grind to suitable fineness. Mix the ground figs, other ingredients and enough water for proper consistency until all are uniformly distributed.

For other fig pastes vary the proportions of sugar, corn syrup and

Nulomoline, one to another, but keep the total of these in about the proportion to the ground figs as specified in the above formula.

TASTY CHEWY COOKIES

(Molasses Coconut Bars, Rich Crust, Crisp, Chewy Eating Qualities. For Hand Rolled or Bar Machine.)

	Small Batch	Large Batch
Sugar	3½ lb.	35 lb.
Shortening (preferably part butter)	2 lb.	20 lb.
Salt	1½ oz.	1 lb.
Grandma's Molasses	2½ lb.	25 lb.
Nulomoline	1½ lb.	15 lb.
Coconut (macaroon)	4 lb.	40 lb.
Flavor (mild-vanilla, lemon or spice)	As desired	As desired
Water	1¼ lb.	12 lb.
Ammonia	¼ oz.	⅛ lb.
Flour	10 lb.	100 lb.
Soda	1¼ oz.	¾ lb.

Cream the sugar, shortening and salt.

Add the Grandma's Molasses, Nulomoline, coconut and flavor and mix until distributed.

Meanwhile, dissolve the ammonia in the water and separately blend the soda and flour.

Add the ammonia solution and the flour blend to the creamed ingredients while mixing slowly, and mix the dough smooth.

The consistency of this dough is suitable for the bar machine. For rolling out and cutting by hand or bagging by hand, change the water content to secure suitable consistency.

ECONOMY GINGER SNAPS

(With Crumbs and Low Shortening Content, High Production, Low Cost Cookies Made on a Rotary Shortbread Machine.)

Sugar (powdered)	10 lb.
Salt	1 lb.
Nulomoline	5 lb.
Grandma's Old-Fashioned Molasses	50 lb.
Crumbs	15 lb.
Ginger	1¼ lb.
Shortening	17½ lb.
Soda	2¼ lb.
Flour	100 lb.

Bring the sugar, salt, Nulomoline and Grandma's Molasses to a boil.

Meanwhile, place the crumbs and ginger in a mixer and mix until the crumbs are broken into very fine particles. Pour the hot molasses solution onto the crumbs, add the shortening and mix smooth.

Separately blend the soda and flour and add the blend to the crumb mixture. Mix the dough smooth.

Allow the dough to rest (at least an hour or more) until cool and until it tightens sufficiently to become dry enough to run on the machine without sticking.

HONEY VARIETIES

(Basic Formulas for Peppernuts, "Honey" Gingerbread Men, Santa Claus and Other Cut Out Christmas Cookies, Cobblestone "Honey" Cakes, etc.)

VARIETY PEPPERNUTS

(A basic Pfeffernuss Formula with Which to Make Modifications to Suit Individual Preferences. Using a "Stock Dough." For Wire-Cut Machine and Hand Production.)

Small Batch		Large Batch
1 lb.	Eggs (whole)	10 lb.
¾ oz.	Ammonia	½ lb.
¾ oz.	Soda	½ lb.
¾ oz.	Salt	½ lb.
1¼ oz.	Cinnamon	¾ lb.
¾ oz.	Allspice	½ lb.
⅜ oz.	Cloves	¼ lb.
⅜ oz.	Mace	¼ lb.
⅜ oz.	Cardamom	¼ lb.
¼ oz.	Pepper (Optional)	⅛ lb.
As desired	Anise	As desired
20 lb.	Stock Dough (see next formula)	200 lb.
1 lb.	Shortening (preferably part butter)	10 lb.
1½ lb.	Nuts (chopped walnuts, cashews, etc.)	15 lb.
1 lb.	Fruit (mixed glaced; ground)	10 lb.

Stir together the eggs, ammonia, soda, and salt.

Add to the egg mixture the cinnamon, allspice, cloves, mace, cardamom, pepper, and anise and mix until smooth.

Add this spice-egg mixture in small amounts to the stock dough and mix well after each addition. . . . Add the shortening and mix in.

Just before finishing the mixing, add the nuts and fruit and mix the dough smooth.

FOR HAND WORK, roll into cylinders about ¾ inch in diameter, cut about ½ inch long, round to form balls and place on pans.

FOR WIRE-CUT MACHINE production, make the dough softer by adding extra eggs or milk until suitable for depositing.

INCREASE or DECREASE the leavening agents; more ammonia produces higher "puff"; more soda makes a wider spread.

CHANGE the FLAVOR by using different combinations of spices; and more or less.

Also, the nuts and ground fruits may be altered one to another or the total increased, decreased or omitted.

MAKE the PEPPERNUTS MORE OR LESS TENDER by increasing, decreasing or omitting the shortening.

Bake at about 380 degrees F.

To keep the peppernut cookies soft, they should be coated as soon as possible after baking, with the "snow bank" peppernut coating and rolled in powdered sugar.

Be sure the package labels comply with the FOOD LAWS. Some laws require that when the word, "Honey," is used on labels, honey must be used solely or in preponderant proportions in the product.

STOCK DOUGH

(For use in Peppernuts, Christmas Cookies, Cobblestone "Honey" Cakes, etc.)

	Small Batch	Large Batch
* Nulomoline (Honey, Grandma's Molasses)	10 lb.	100 lb.
Flour	10 lb.	100 lb.

* The Nulomoline may be combined with or replaced by all or part of Grandma's Old-Fashioned Molasses or honey; about ¼, ½ or ¾, depending upon individual preferences.

Heat the Nulomoline barely to a boil or preferably to about 180 degrees F. Add the flour to it and mix into a dough.

Use this dough immediately (or, preferably, after ageing for a few days, weeks or months) for peppernuts, Christmas cut-out cookies and cobblestone "honey" cakes.

SNOW WHITE CUP CAKES

(Close Grain, Fair Volume, Chewy.)

	Small Batch	Large Batch
Sugar (fine granulated)	5 lb.	50 lb.
Milk (dry)	1¼ lb.	12 lb.
Flour	2½ lb.	25 lb.
Shortening	2½ lb.	25 lb.
Nulomoline	1½ lb.	15 lb.
Flavor	As desired	As desired
Soda	1½ oz.	1 lb.
Water	5 lb.	50 lb.
Flour	7½ lb.	75 lb.
Eggs (Whites)	3½ lb.	35 lb.
Sugar (fine granulated)	3½ lb.	35 lb.
Salt	3¼ oz.	2 lb.
Cream of tartar (or other acid leavener)	3½ oz.	2¼ lb.

Cream the first portion of sugar, the powdered milk, flour, shortening, Nulomoline and flavor.

Dissolve the soda in the water and, then, while continuing the creaming, carefully add about one-third of the dissolved soda. Add the remainder along with the second portion of flour.

In the meantime, whip the egg whites, sugar, salt and cream of tartar until fairly stiff. Carefully add the whipped eggs to the creamed mixture. Mix the batter until it is smooth.

OLD FASHIONED HEALTH MUFFINS

(Rich, Flavorfully Sweet, Large Size, Made with Whole Wheat Flour.)

	Small Batch	Large Batch
Shortening (preferably part butter)	1½ lb.	15 lb.
Flour (clear)	1½ lb.	15 lb.
Nulomoline	1 lb.	10 lb.
Salt	2½ oz.	1½ lb.
Eggs (whole)	1¼ lb.	12 lb.
Grandma's Molasses	2 lb.	20 lb.
Milk (liquid basis)	7 lb.	70 lb.
Soda	¾ oz.	6½ oz.
Flour (clear)	2 lb.	20 lb.
* Flour (whole wheat)	6½ lb.	65 lb.
Baking powder	5¼ oz.	3¼ lb.
Rasins, currants, figs, blueberries, etc. (optional)	1-2 lb.	10-20 lb.

* Other flours may be used to replace all or part of the whole wheat and clear flours, such as patent white flour, bran and corn meal.

Cream the shortening, first portion of clear flour, Nulomoline and salt. While continuing the creaming, add the eggs. Gradually add the Grandma's Molasses.

In the meantime, dissolve the soda in the milk and blend the second portion of clear flour, whole wheat flour and baking powder.

Add the dissolved soda along with the blended ingredients to the creamed mass. Mix the batter until it is smooth.

APRICOT GLOSS

Formula No. 1

Apricot Paste	40 lb.
Apricot Pulp	80 lb.
Cane Sugar	250 lb.
Agar-agar	4 lb.
Water	15 gal.
Citric Acid	4 oz.

Bring the water to a boil, then add 200 pounds of cane sugar, and the fruit with the dissolved citric acid. Cook to 223° F. Transfer to cooling table and work in the solution of agar-agar mixture until uniformly mixed.

Formula No. 2

Soak overnight in water to cover agar-agar.

Agar-agar	2 lb.

Bring to a boil in a 25-gallon copper kettle:

Sugar	100 lb.
Water	1 qt.
Apricot Pulp	62½ lb. (10 cans of 6 lb. 4 oz.)

Add the above agar-agar, and bring anew to a boil under good stirring. When thoroughly mixed, shut off steam immediately. Strain under a roller strainer into 30-pound pails.

Let the agar-agar soak overnight in 10 gallons of water. In the morning transfer to kettle, bring to a boil and add the 50 pounds of sugar. Cook to 223° F., and then mix the batch with the apricot cook on the cooling table.

If the above gloss is too tough add less agar-agar, if too soft add more agar-agar.

Agar-agar: Malayan name for a seaweed, known also as Ceylon Moss and Jaffna Moss. Agar-agar is employed by bacteriologists for the cultivation of bacteria. In the food industry it serves to gelatinize food products.

Agar-agar in powder is added sometimes to pudding powders (1%) to make the pudding smooth.

FRUIT FILLING

Ground Dates	10 lb.
Fig Jam	10 lb.
Sweetened Apple Sauce	4 lb.
Chopped Nut Meats	3 lb.

Mix the above ingredients.

PREPARED FLOURS

DOUGHNUT FLOUR

The following directions should be followed carefully to obtain a quality product:

a. Sieve the prepared doughnut flour into a mixing bowl.
b. Make a hole in the center of the flour and pour cold water into it.
c. Fold flour into the water, mix well but avoid over mixing. A cake mixing machine can be used.
d. Doughnuts should be fried soon after mixing.

e. The temperature of the dough should be between 70 to 75° F., to get maximum expansion and minimum grease absorption.

f. In the summer time add cold water, in the winter, warm water, to the flour. In this way the temperature of the dough can be controlled.

g. The temperature of the dough is important because it has a governing factor at which temperature it hits the grease. The best frying results are obtainable at 390 to 400° F.

h. Under certain conditions the preparation of flour and water may have to vary slightly. Only by experimentation can this be determined. For bench work use approximately 2 pounds cold water and 5 pounds prepared doughnut flour.

DOUGHNUT FLOUR

Formula No. 1

Soft wheat patent	88 lb.
Hard wheat patent	10 lb.
Granulated sugar	32 lb.
Powdered skim milk	5 lb.
Powdered egg yolk	5 lb.
Shortening	5 lb.
Soda	13 oz.
Sodium Acid Pyrophosphate Salt	1 lb.
Ground Mace	2 oz.

The above formula is an example around which to construct a product to suit the individual's taste. The flavoring material may consist of solid spices or their corresponding oils.

DOUGHNUT FLOUR

Formula No. 2

Sugar	20 lb.
Shortening	3½ lb.
Mace Oil	⅛ oz.
Cinnamon Oil	10 drops
Salt	1 lb.
Vanillin	To suit
Powdered Egg	2 lb.
Skim Milk	5 lb.
Cake Flour	61 lb.
Baking Powder	3 lb.

Use fine granulated sugar. Cream the shortening with the sugar, and add the spice oils. Beat up egg with sugar, and add some creamed shortening. Then add this to the creamed sugar. Sift the cake flour, milk powder, and baking powder and add to creamed sugar. Put through a mixer and sifting machine.

DOUGHNUT FLOUR

Formula No. 3

Sugar	29 lb.
Shortening	3½ lb.
Mace Oil	⅓ oz.
Salt	1 lb.
Vanillin	To suit
Powdered Egg	4 lb.
Skim milk	4 lb.
Cake flour	57 lb.
Baking powder	3½ lb.

Mix the same as suggested above for formula No. 2.

To make doughnuts use 16–17 pounds of doughnut flour with 3¼ quarts of water. Baking temperature around 390° F.

POWDERED DOUGHNUT SUGAR

Pulverized dextrose	75 lb.
Cake flour	10 lb.
XXXX sugar	9 lb.
Shortening (around 96° F. Melting Point)	5 lb.
Vanillin	1 oz.

Melt the shortening and cream with some of the dextrose sugar. Gradually work in the balance of the dextrose, and when thoroughly incorporated add the balance of the ingredients. Put the entire mix through a mixer and sifting machine.

PANCAKE FLOUR:

A good pancake flour not only adds to the cereal consumption of many households but also offers a possibility of marketing certain grades of flour to better advantage. What should a good pancake flour be like? A thousand types and tastes can be produced by combining different flours and other ingredients in various combinations and it is impossible to say which is the best, it is all a matter of taste. However, no one likes a soggy, tough or rubbery pancake. The ideal pancake should be light, fluffy and tender and, in compounding a prepared flour that is to yield such pancakes, a number of facts must be observed.

A satisfactory pancake flour should contain:

Wheat, soft and hard
Corn
Buckwheat
Rice
Rye
Soya

Powdered skim milk or powdered buttermilk.
Corn sugar or cane sugar
Salt
Leavening: bicarbonate of soda and acid phosphate.

These ingredients may be combined to produce:

A wheat pancake flour
A corn pancake flour
A buckwheat pancake flour
A mixed pancake flour of no particular type.

Pancakes made from wheat flour only have a tendency to be rubbery. To avoid this feature, clears and longer extractions should be used. Hard wheat flour (although not as important in pancake flours as it is in the most prepared doughnut mixes) helps to improve the texture and volume of the pancake. Whole wheat or small amounts of fine middlings are very helpful additions to soft wheat flours.

A wheat pancake flour can also be improved by the addition of corn or rice flour. Both of these flours make for a short pancake, rice flour more so than corn flour. Where improvement of the physical structure of the pancake is desired without impairing the original taste, rice should be used rather than corn. Corn flour has a strong characteristic taste and as its content approaches 50% of the total, the taste of corn begins to predominate.

Corn pancake flours should contain some wheat to counteract excessive mealiness and bitterness. The addition of wheat improves the gas retention of the batter and the texture of the corn pancake. There is no need of adding rice flour to a typical corn pancake flour.

Buckwheat flour also has a strong flavor. It produces a rather syrupy batter and a short but heavy cake. Wheat may be added in quantities up to 30 to 50%, to improve the cakes in volume and tenderness. With increasing percentage of wheat, better gas retention is obtained, resulting in better volume. Rye and soya flours may be regarded as flavoring ingredients, but only up to 10% of rye or soya flour in the flour mix can safely be recommended. Particular precaution is necessary when rye flour is used. Rye has the tendency to produce a soggy pancake with heavy crust. Adequate amounts of corn flour (at least 50% corn per 10% of rye) should be included in the flour mixture to insure proper baking quality. However, a small amount of rye is sufficient to impart its aroma to the pancake.

Powdered milk lends a richer flavor to the pancake. Dry skim milk is a more common ingredient than dry buttermilk. The latter produces a cheesy flavor and is preferably used in wheat pancake flours. Between 2 and 5% of powdered milk (based on the flour used) should be sufficient

in most formulas. The large proportion of milk sugar in dry milk is helpful in producing the much desired golden-brown outside of the pancake.

The brown color may also be obtained by adding a small percentage of sugar. Corn sugar has very much less sweetening power than cane sugar, but a better browning effect. Sweetness in a pancake, however, is of comparatively little importance as it is commonly eaten with some kind of syrup.

Since the golden-brown crust can be also achieved by the addition of milk, addition of sugar to the mix may not be necessary. Between 2 and 5% of cane sugar, or up to about 10% of corn sugar, may be used. However, as little as 1% of corn sugar can be sufficient to produce the desired coloring effect.

About 2% (or just a trifle more) of salt is adequate in most cases. Many people prefer about 2½%, but it seems wise to stay somewhat on the low side, since extra seasoning can easily be added by the housewife.

Tenderness and volume of the pancake will largely depend on types and mixture of flours used, but also on the quantity and type of leavening added to the mix.

Mono-calcium phosphate, which (in combination with bicarbonate of soda) represents the most common leavening in self-rising flours, lends itself admirably to pancake baking. Most of the gas evolution should take place in the cold batter, giving it a foamy, fluffy structure before it goes on the griddle. Mono-calcium phosphate, a relatively fast-acting baking acid, serves this purpose very well.

Mono-calcium phosphate is usually applied at a ratio of 100 parts to 80 parts of sodium bicarbonate. In a pancake flour, a ratio of 100 parts of phosphate to 82–85 parts of soda (according to the acid strength of the phosphate), may often show an advantage over the common ratio of 100/80. This slight shift towards the alkaline side makes for a more tender pancake.

The amount of leavening added to the pancake flour will depend on the types of flour used. Buckwheat and corn flour require more leavening for best results than plain wheat formulae.

Generally a leavening mixture based on 1.5–2% of soda will be found sufficient in a wheat pancake flour. Normally, 2–2.5% should give better results in buckwheat and corn cakes.

After considering any local preference for this or that type of pancake —not forgetting the fact that flour mixtures containing 50% or more wheat are subject to a government tax—the producer can easily decide just what kind of pancake flour should be turned out for local consumption.

PANCAKE FLOURS

1. Mixed Type

Soft wheat clear	35 lb.
Buckwheat flour	35 lb.
Corn flour	15 lb.
Rice flour	15 lb.
Powdered skim milk	3 lb.
Cane sugar	3 lb.
Salt	2.25 lb.
Bicarbonate of soda	2 lb.
Mono-calcium phosphate	2.4 lb.
	112.65 lb.

2. Buckwheat Type

Buckwheat flour	60 lb.
Corn flour	15 lb.
Soft wheat clear	25 lb.
Powdered skim milk	3 lb.
Salt	2.25 lb.
Bicarbonate of soda	2.25 lb.
Mono-calcium phosphate	2.75 lb.
	110.25 lb.

3. Corn Type

Corn flour	65 lb.
Soft wheat clear	35 lb.
Powdered skim milk	3 lb.
Corn sugar	5 lb.
Salt	2.25 lb.
Bicarbonate of soda	2.5 lb.
Mono-calcium phosphate	3 lb.
	115.75 lb.

4. Containing Soya Flour

Hard wheat patent	70 lb.
Corn flour	20 lb.
Soya flour	10 lb.
Powdered skim milk or buttermilk	5 lb.
Cane sugar	5 lb.
Salt	2.25 lb.
Bicarbonate of soda	2 lb.
Mono-calcium phosphate	2.4 lb.
	116.65 lb.

5. Containing Rye Flour

Corn flour	60 lb.
Soft wheat	30 lb.
Rye	10 lb.
Corn sugar	6 lb.
Salt	2.25 lb.
Bicarbonate of soda	2.5 lb.
Mono-calcium phosphate	3 lb.
	113.75 lb.

Prepared waffle flours are, in some localities, used a great deal for waffle baking. Corn and wheat flour mixtures generally yield good waffles, shorter extractions of wheat being more suitable for waffle than for pancake baking. Buckwheat formulae yield heavy and rubbery waffles and the percentage of buckwheat in the flour mixture must be cut down if a satisfactory waffle is to be obtained.

Mixing a pancake flour in the mill offers hardly any more difficulties than compounding a self-rising biscuit flour. Where a small mixer is used, it is convenient to compound first a basic mix, consisting of all ingredients, but containing only a small part of the flour. This mix should be large enough to supply as many batches as are made within a day. In this manner part of the scaling job and some possibilities of errors are avoided; also a more uniform distribution of the leavening is obtained.

Pancake flours do not usually keep during storage as well as self-rising biscuit flours. The types of flours mostly used in pancake mixes are more subject to insect pests, rancidity and mustiness. Utmost care and cleanliness in the milling and compounding are, therefore, of great importance.

PREPARED WAFFLE FLOUR

Formula No. 1

Flour (general purpose type)	100 lb.
Soda (sodium bicarbonate)	1½ lb.
Mono-calcium phosphate	1 lb. 3 oz.
Sodium acid pyrophosphate	1 lb. 2 oz.
Flour salt	2 lb.
Powdered whole egg	3 lb.
Sugar	12½ lb.
Shortening (plastic)	20 lb.
Dry milk solids	12½ lb. or more

Mix flour and soda for 2 or 3 minutes before adding remainder of dry ingredients. Continue mixing to make total time of 20 minutes.

Add shortening. If horizontal ribbon type mixer is used, continue mix-

ing for 45 minutes. If trowel type is used, continue mixing for 8 to 12 minutes, depending upon consistency of shortening and mixing room temperature. If horizontal ribbon type mixer is strung with cutting wires (as sometimes used for pie crust mixes), continue mixing for 25 to 30 minutes.

Do not continue mixing beyond the period necessary to get uniform, homogeneous distribution of shortening.

Directions: Mix 1 pound of waffle flour with 10 fluid ounces of water. Grease the iron and bake until golden brown.

Formula No. 2

Sugar, Powdered	3 lb.
Cottonseed Oil	1 lb.
Whole Egg Powder	12 oz.
Winter Wheat Flour	8 lb.
Baking Powder	6 oz.
Salt	2 oz.

Incorporate the oil into the flour, follow with the egg powder, sugar, and the salt. Add the baking powder last. The oil and flour are best prepared in a mixing machine and, when dry enough, transferred to a powder mixing machine, provided with a sifter on top (Day Mixer).

SELF RISING FLOURS:

PANCAKE FLOUR

Mono Calcium Phosphate	7 lb.
Bicarbonate of Soda	3¼ lb.
Fine Salt	3 lb.
Kiln-dry White Corn Flour	100 lb.
Medium Grade Wheat Flour	86¼ lb.

PANCAKE FLOUR (Blend Type)

*Flour blend	100 lb.
Soda (sodium bicarbonate)	2 lb.
Mono-calcium phosphate	2½ lb.
Flour salt	2 to 2½ lb.
Dextrose (corn sugar)	3½ lb.
Dry milk solids	3½ lb.

*Flour may be a wheat flour blend, a buckwheat blend, a cornmeal blend or a wheat, corn, rye and rice mixture.

Mix flour and soda for 2 or 3 minutes before adding remainder of ingredients. Continue mixing to make total time of 20 minutes. Horizontal ribbon type mixer is generally used.

BUCKWHEAT FLOUR

Mono calcium phosphate	7 lb.
Bicarbonate of soda	3¼ lb.
Fine salt	3 lb.
Buckwheat flour	130 lb.
Low grade wheat flour	56¾ lb.

BISCUIT FLOUR

Mono calcium phosphate	7 lb.
Bicarbonate of soda	3¼ lb.
Fine salt	3 lb.
Winter wheat flour	186¾ lb.

POUND CAKE FLOUR

Directions: Mix 1 pound of cake flour with ½ pint of cold water. Make dough, put in molds, and bake at 400° F.

Winter wheat flour	3 lb.
Egg yolk, granulated	½ lb.
Baking powder	¼ lb.
Milk powder	10 oz.
Sugar	2 lb. 2 oz.
Salt	1½ oz.
Cottonseed oil	5 lb.
Vanol (concentrated vanilla flavor)	¼ oz.
Lemon oil	¼ oz.

PREPARED POWDERED CAKE MIXES

SPICY CAKE MIX

Flour	8 lb.
Ground Cinnamon	1½ lb.
Cream of Tartar	2 lb.
Bicarbonate of Soda	3 lb.
Ground Mace	½ lb.
Ground Nutmeg	½ lb.
Ground Cardamom	½ lb.
Ground Ginger	½ lb.
Ground Cloves	½ lb.

RECIPE

Rub up

Shortening	¾ lb.
Granulated Sugar	3¾ lb.

Add

Eggs	5 lb.
Spicy Cake Mix	1 lb.
Salt	1 oz.

Gradually add		
Sour Milk or Buttermilk	3	qt.
Cake Flour	7	lb.
Ground Raisins	2	lb.

Bake in slow oven. This will make layer, sheet, and loaf cake; also cup cake and muffins. A 2-layer, 7-inch cake with icing will cost about 10 cents to make. A trade winner.

DEVIL'S FOOD MIX

Brown Sugar	15	lb.
Bicarbonate of Soda	6	lb.
Cream of Tartar	4	lb.
Winter Wheat Flour	30	lb.
Dutch Cocoa	15	lb.
Ground Cinnamon	4	oz.
Vanillin	3	oz.
Powdered Buttermilk	7½	lb.
Chocolate Color	4½	oz.
Amaranth	1½	oz.

RECIPE

Cream up		
Sugar, Granulated	2½	lb.
Shortening	1	lb.
Eggs	1	pt.
Now add		
Devil's Food Mix	2	lb.
Salt	1	oz.
Mix thoroughly, then add		
Flour	2¼	lb.

Thin down with water (2 to 2½ pints) to desired consistency. Bake in temperature of 350° to 375° F.

SPONGE CAKE MIX

XXXX Sugar	6	lb.
Granulated Egg Yolk	1½	lb.
Skim Milk Powder	1	lb. 14 oz.
Baking Powder	7	oz.
Albumen	8	oz.
Winter Wheat Flour	6	lb.
Salt	1½	oz.
Lemon Oil	15	drops
Egg Color	Trace	

CHOCOLATE SPONGE CAKE MIX

As Sponge Cake Mix but use		
Cocoa	¾	lb.
and		
Flour	5¼	lb.

Nothing to add but water. Will produce any form of Sponge Cake, Sponge Layers, Sheet Layers, Loaf Cakes, Lunch Cakes, Jelly Rolls, etc.

Directions: Take 12 ounces of lukewarm water and mix with 2 pounds of Sponge Cake Mix and make dough. Then put in machine and beat for 4 minutes. Scale into pans, bake in a moderate oven.

SUGAR COOKIE MIX

XXXX Sugar	3 lb.
Winter Wheat Flour	6 lb.
Cottonseed Oil	6 oz.
Bicarbonate of Soda	1 oz.
Egg Yolk, Granulated	1 oz.
Whole Milk Powder	5 oz.
Salt	1½ oz.
Egg Color, Dandy Cake Flavor	Trace

SPICY COOKIE MIX

Brown Sugar	3 lb.
Winter Wheat Flour	6 lb.
Cottonseed Oil	6 oz.
Bicarbonate of Soda	1 oz.
Egg Yolk, Granulated	1 oz.
Buttermilk Powder	5 oz.
Salt	1½ oz.
Cinnamon	1 oz.
Allspice	¼ oz.
Ginger	¼ oz.
Nutmeg	¼ oz.

A preparation that will produce quickly and at a low cost the most delicious cookies.

Directions: Mix 5 pounds of Cookie Mix with 1 quart of water and make dough.

Roll out and cut.

Two pounds of Cookie Mix makes 3½ to 4 dozen cookies.

YELLOW LAYER CAKE

Cake Flour	5 lb.
Baking Powder	5 oz.
Powdered Whole Milk	1 lb.
Granulated Sugar	6½ lb.
Shortening	2 lb.
Powdered Egg Yolk	1 lb.
Salt	2 oz.
Vanilla Extract	1 oz.
Cornstarch	8 oz.

Sift together flour, baking powder, and milk. Cream the sugar with the shortening and add the egg. Carefully mix all of the ingredients. This mixture will require about 5 pounds of water.

Bake in oven at 420° F. for about 15 to 20 minutes.

DEVIL FOOD LAYERS

Cake Flour	5 lb.
Baking Powder	3 oz.
Powdered Whole Milk	1 lb.
Granulated Sugar	5 lb.
Shortening	2 lb.
Egg Albumen	4 oz.
Gum Tragacanth	2 oz.
Skim Milk	1 lb.
Cocoa Powder	1 lb.
Baking Soda	2 oz.
Salt	2 oz.

Sift together all but the sugar and shortening, which should be creamed and then added to the sifted mixture. This mixture will require about 7 pounds of water.

Bake in oven heated to about 400° F.

WHITE POUND CAKE

Cake Flour	5	lb.
Powdered Whole Milk	1	lb.
Granulated Sugar	5	lb.
Shortening	2½	lb.
Powdered Egg Albumen	4	oz.
Gum Tragacanth	2	oz.
Vanilla Extract	1	oz.
Salt	1	oz.
Baking Powder	3	oz.

Cream shortening and sugar, then add to the other ingredients, which have been sifted all together. Mix carefully. This mixture will require about 5 pounds of water.

Bake in a slow oven at 300° F. to 325° F.

YELLOW POUND CAKE

Cake Flour	5	lb.
Powdered Whole Milk	10	oz.
Granulated Sugar	6	lb.
Shortening	3	lb.
Powdered Egg Yolk	1½	lb.
Powdered Mace	3	g.
Salt	2½	oz.

Cream shortening and sugar, then add to the other ingredients, which have been sifted all together. Mix thoroughly. This mixture will require about 4 pounds of water.

Bake 1 hour in a moderate oven at about 350° F.

LEMON CUP CAKES

Cake Flour	5	lb.
Powdered Whole Milk	1	lb.
Granulated Sugar	6	lb.
Baking Powder	5	oz.
Shortening	2	lb.
Powdered Egg Yolk	12	oz.
Powdered Egg Albumen	½	oz.
Powdered Lemon Juice	7	oz.
Salt	1½	oz.

Cream sugar and shortening. Sift all other ingredients and mix well together. Then work in about 5 pounds of water and mix until smooth and creamy. Fill into baking cups and bake in an oven at 375° F. to 400° F. for about 20 minutes. Use a Lemon Fondant Icing.

HIGH RATIO CHOCOLATE MALTED MILK CAKE

Cake Flour	5	lb.
Skim Milk Powder	1½	lb.
Malted Milk Powder	1½	lb.
Granulated Sugar	7	lb.
Shortening	2½	lb.
Baking Powder	3½	oz.
Baking Soda	¾	oz.
Powdered Egg Yolk	12	oz.
Vanilla Extract	½	oz.
Dark Cocoa Powder	2	lb.
Salt	3	oz.

Cream sugar and shortening, then add to the rest of the ingredients, which have been sifted together, and mix thoroughly. This mixture will require about 10 to 12 pounds of water to make a smooth creamy dough.

Bake at 375° F.

HIGH RATIO SPICE CAKE

Cake Flour	5	lb.
Skimmed Milk Powder	10	oz.
Granulated Sugar	3½	lb.
Brown Sugar	3	lb.
Powdered Molasses	1	lb.
Shortening	3	lb.
Powdered Egg Yolk	1	lb.
Powdered Egg Albumen	1	oz.

Baking Powder	5	oz.
Salt	2	oz.
Cinnamon	50	g.
Cardamom	20	g.
Cloves	10	g.
Nutmeg	10	g.
Ginger	10	g.

Cream shortening and sugar, then add to the other ingredients, which have been sifted all together. This mixture will require about 7 pounds of water.

Bake in oven at about 375° F.

HIGH RATIO DEVIL'S FUDGE CAKE

Cake Flour	4	lb.
Skimmed Milk Powder	12	oz.
Sugar	7	lb.
Dark Cocoa Powder	1	lb.
Powdered Egg Yolk	1¾	lb.
Powdered Egg Albumen	1	oz.
Baking Powder	3	oz.
Baking Soda	1	oz.
Shortening	2½	lb.
Salt	3	oz.
Vanilla Extract	To taste	
Cinnamon	½	oz.

Carefully mix and sift the above ingredients. The amount of water needed for the proper dough consistency is about 8 pounds. Mix until smooth. This formula may be used for layer cake, cup cakes, loaf cakes, etc.

Bake in oven at about 375° F.

HIGH RATIO PLATINUM WHITE CAKE

Cake Flour	5	lb.
Skimmed Milk Powder	12	oz.
Granulated Sugar	7	lb.
Shortening	2	lb.
Powdered Egg Albumen	4	oz.
Gum Tragacanth	10	oz.
Baking Powder	5	oz.
Cream of Tartar	1	oz.
Vanilla Extract	3	oz.
Salt	3	oz.

Carefully mix and sift all the ingredients until a uniform powder. Add about 7 pounds of water and mix until smooth and creamy. This formula

may be used for layer cakes, cup cakes, ring cake, sheet cake, and loaf cakes.

Baking temperature depends upon the form of cake to be baked.

HIGH RATIO GOLDEN CAKE

Cake Flour	5 lb.
Skimmed Milk Powder	14 oz.
Sugar	7 lb.
Shortening	2 lb.
Powdered Egg Yolk	12 oz.
Baking Powder	4 oz.
Salt	3 oz.
Vanilla Extract	3 oz.

Carefully mix these ingredients into a uniform powder. Add about 8 pounds of water and mix thoroughly until a smooth consistency is formed.

Bake in oven at 375° F.

This formula may be used for strawberry shortcake, jelly rolls, cup cakes, layer cakes, etc.

POUND CAKE FLAVOR

Cornmeal	10 lb.
Granulated Egg Yolk	3 lb.
Rice Flour	6 lb.
Peanut Oil	1 pt.
Mace Oil	1 oz.

POUND CAKE FLAVOR

Mace	¼ oz.
Nutmeg	¼ oz.
Apple Pie Flavor	2 oz.
Sugar	5 lb.
Tapioca Flour	5 lb.
Lemon Oil	¼ oz.
Orange Oil	¼ oz.
Vanillin	¼ oz.

MIXED SPICES

A. CAKE SPICES

For fruit and spice cakes.

Cinnamon, Ground	1 lb.
Ginger, Ground	¼ oz.
Cloves, Ground	4 oz.
Mace, Ground	1 oz.

APPLE PIE SPICE

Mace, Ground	½ lb.
Cinnamon, Ground	1½ lb.
Cayenne Pepper	1¼ lb.

If mace is high, use nutmeg.

MINCE MEAT SPICE

Cinnamon	67½ lb.
Allspice	22½ lb.
Cloves	22½ lb.
Mace	14½ lb.

MILK CHOCOLATE CAKE POWDER (Rich Mix)

Cake Flour	5 lb.
Granulated Sugar	6 lb.
Powdered Whole Milk	12 oz.
Shortening	2½ lb.
Powdered Whole Egg	3 oz.
Powdered Egg Yolk	1½ oz.
Cocoa Powder Natural	12 oz.
Salt	2 oz.
Baking Soda	½ oz.
Nulomoline	1 lb.
Baking Powder	3 oz.
Vanilla Flavor	As desired

All ingredients should be sifted. Cream shortening, sugar, and Nulomoline. Add slowly while creaming, powdered milk, eggs, cocoa, baking soda, powder, salt and flour. Flavor with vanilla. This mixture will require about 4 pounds of water.

Bake in layer cake forms at about 375° F.

DEVILS FOOD CAKE (Powdered Mix)

Cake Flour	5 lb.
Powdered Whole Milk	8 oz.
Granulated Sugar	2½ lb.
Brown Sugar	4½ lb.
Cocoa Powder	1 lb.
Shortening	2 lb.
Egg Albumen	2.4 oz.
Baking Powder	3.5 oz.
Salt	1.6 oz.
Vanillin	As desired

All ingredients should be sifted. Cream shortening, sugar, then add while creaming, milk, cocoa, albumen, baking powder and the balance.

This mixture will require about 8 pounds of water. Bake at 360–375° F.

EGG CUP CAKE

Shortening	10 oz.
Sugar	30 oz.
Flour	30 oz.
Powdered Egg Yolk	5 oz.
Powdered Skimmed Milk	5 oz.
Baking Powder	1.6 oz.
Salt	½ oz.
Vanillin	Enough to suit

Bake in moderate oven (375° F.)

GINGER BREAD

Flour	20 oz.
Sugar	4 oz.
Molasses	10 oz.
Shortening	4 oz.
Whole Yolk	1 oz.
Salt	2 g.
Cinnamon	5 g.
Ginger	5 g.
Nutmeg	1 g.
Cloves	½ g.
Baking Powder	4 g.
Baking Soda	5 g.
Water (Boiling)	7 oz.

Combine shortening, salt and spices. Cream in sugar until light, add eggs, beat thoroughly, add molasses. Add to creamed mixture the blended flour, soda, and baking powder. Mix well, then add boiling water, beat until smooth. Bake (350° F.) for 50–60 minutes.

PIE CRUST

Cake Flour	25 lb.
Shortening	18 lb.
Salt	½ lb.
Water	6 lb.
Skimmed Milk Powder	¼ lb.

Mix the skimmed milk powder with the flour. Then mix all the shortening with the flour. Add the cold water slowly to the batch and mix very little.

GLAZES AND WASHES FOR BAKERY GOODS

Glucose	2 lb.
Water	1 lb.

Bring to a good boil, and apply to pieces as they come from the oven.

FRUIT CAKES

	Golden Fruit Cake	White Fruit Cake	Spice Fruit Cake
Flour	5 pounds	5 pounds	5 pounds
Sugar	3½ pounds	3½ pounds	
Brown Sugar	....	....	5 pounds
Molasses	2 pounds	....	1 pound
Honey	1 pound	1 pound	
Butter	12 ounces	1 pound	4 ounces
Shortening	3 pounds	3 pounds	3 pounds
Milk	4 ounces	8 ounces	3 pounds
Caramel Color	....	....	3 ounces
Whole Eggs	3 pounds	4 pounds	3 pounds
Salt	3 ounces	2 ounces	4 ounces
Cinnamon	1½ ounces	....	1 ounce
Mace	½ ounce	....	½ ounce
Cloves	1 ounce	....	½ ounce
Vanilla Extract	½ ounce	¼ ounce	¼ ounce
Almond Flavor	....	1 ounce	¼ ounce
Lemon Flavor	1 ounce	....	....
Rum Flavor	1 ounce	....	....
Baking Powder	5 ounce	5 ounce	5 ounce
Fruit Mixture:			
Seedless Raisins	6 pounds	7 pounds	6 pounds
Sliced Citron	3 pounds	3 pounds	1 pound
Sliced Lemon Peel	¼ pound	....	....
Sliced Orange Peel	½ pound	3 pounds	....
Walnut, Pecan Pieces	3 pounds	....	1 pound
Cherry Pieces	2 pounds	3 pounds	2 pounds
Chopped Dates	2 pounds	2 pounds	2 pounds
Water	2 pounds	....	....
Sugar syrup	1 pound	....	....
Almonds	....	2 pounds	....

Cream shortening, add sugar, syrups, beat well, then add egg, milk, etc. Sift flour with baking powder, salt and spices and add to creamed sugar, etc. Sift part of the flour over the fruit, add to batter and add the nuts last. Place in loaf pans lined with greased paper. Cover tightly.

Bake with light steam for 1½–3 hours at 325–350° F.

Remove covers at end of first hour, and finish baking.

Cover fruit mixture with damp cloth overnight.

PECTIN GLAZE FOR FRUIT TARTS

No. 100 Pectin Powder	2 oz.
Sugar	4½ lb.
Water or Fruit Juice	1¼ qt.
50% Phosphoric Acid.	1¼ oz.

Mix pectin with 1 pound of sugar. Bring liquids to boil and add remaining sugar. Shut off steam and stir the sugar until dissolved. Then add the pectin-sugar mixture, stirring it around. Allow liquid to cool, then add the acid. This will give a high gloss to fruit tarts.

CAKE SHINE

Water	4 pt.
Sugar	5 lb.
Gelatin	4 oz.

Bring water to a boil, and dissolve the gelatin in it, and immediately add the sugar. When dissolved shut off steam. Apply this shine to cakes while hot.

PECTIN GLAZE OR WASH FOR DANISH PASTRY, SWEET GOODS, ETC.

No. 100 Powdered Pectin	1 lb.
Powdered Cane Sugar	40 lb.
Corn Syrup	50 lb.
Water	4 gal.

Mix 1 pound of pectin with 5 pounds of sugar in a dry pan. Bring water to a boil and add slowly the pectin-sugar mixture, with stirring. Then add balance of sugar, corn syrup, and cook to 220° F.

This syrup is known as Stock Syrup, and is thinned down by adding 1 pint of water to each gallon, for glazing on pastry, etc. Apply this glaze on pastry as soon as taken from oven. By adding 1 ounce of 50% solution of citric acid to 10 pounds of stock syrup, it makes a glaze for any kind of fruit, upon fruit tarts, fruit cakes, etc. After adding acid solution, pour quickly on cakes and spread with a knife before the formed jelly becomes too thick. Add acid to small portions of stock solution at one time.

GLAZED NUT TOPPING

Pectin Stock Syrup	4 lb.
Butter and Shortening	2 lb.
Salt	½ oz.
Vanillin	To suit
Ground Sliced Nuts	1 lb.

Method: The above mixture is creamed lightly and spread on coffee

cake dough, and should be applied to dough before proofing. Makes a nice luster topping.

CRUMB TOPPING

Almond Paste	45 lb.
Granulated Sugar	40 lb.
Skimmed Milk Powder	7 lb.
Gum Acacia	5 lb.
Coconut Butter (Melting Point around 98° F.)	3 lb.

The above mixture is mixed very thoroughly, then placed in a revolving heated compartment until the batch becomes toasted. Break up the product and sift to proper size.

BOILED MERINGUE

(1) Water	1 qt.
Sugar	3 lb.
Meringue Powder	6–8 oz.

Whip to a stiff meringue.

(2) Water	1½ pt.
Sugar	2 lb.
Agar	1 oz.

Mix sugar, agar, and boil for 3 minutes.

When the meringue (1) is thoroughly whipped, reduce the machine to second speed, and then add the hot agar mixture (2) slowly so that it is entirely absorbed as poured in.

GLAZE FOR FRESH BERRY AND OPEN FACE PIES

(1) Water	22 pt.
Sugar	18 lb.
Agar	2 oz.
Fruit (Apricot or Peach, sieved)	10 lb.
Salt	3 oz.

Mix the sugar with the agar, and then boil the entire batch for 3 minutes. Then add (2).

(2) Water	1 qt.
Cornstarch	30 oz.
Color and Flavor	If desired

Mix together.

The above when cooked makes up a clear filling and will seal the fruit when spread over.

NUT TOPPINGS

TOASTED BUTTER TOPPING

Heat slowly to a golden brown tint over a slow fire:

A. Shortening	2 lb.
Butter	2 lb.

Mix and sift together

B. Cake Flour	6 lb.
Cinnamon	3 lb.
Brown Sugar	10 lb.

Now gradually work in the hot butter A, with B, with stirring, and until the mixture turns to soft crumbs.

PECAN COCONUT NUT TOPPING

Mix well

Fine Granulated Sugar	6 lb.
Macaroon Coconut	3 lb.
Chopped Pecans	2 lb.
Salt	½ oz.

Add to the above and mix to a soft paste consistency.
Bring to a boil first.

Water	1 qt.
Shortening	1 lb.

Now spread the above paste evenly and not too thickly on toasting pans, or toast in baking oven, until layer develops a deep golden tint. The layer should be turned once in a while to get uniform heating.

ALMOND BRITTLE TOPPING

Cook to 275° F.

Granulated Sugar	6 lb.
Water	3 pt.
Corn Syrup	2 lb.

Add to above 1 pound of chopped almonds and cook to 310° F. Pour onto pans, not too thick, and when cooled off break up into fine almond brittle, and sift.

SESAME SEED AND PEANUT TOPPING

Cook to 240° F.

Granulated Sugar	3 lb.
Corn Syrup	3 lb.
Water	2 pt.

Add to the above ½ pound of sesame seeds and ¾ pound of chopped

peanuts and cook to 300° F. Pour on pans, not too thick, let cool, break up fine, and sift according to size pieces required.

BASIC CREAM

(1) Water	7	pt.
Sugar	12	lb.
Meringue Powder	20	oz.
Honey	½	pt.
Lemon Emulsion	¼	oz.
Vanilla	3	oz.

Beat the above to a stiff meringue.

(2) Water	3	gal.
Sugar	7	lb.
Agar-Agar	2	oz.
Salt	4	oz.
Cornstarch	3	lb.

Mix the sugar with the agar. Draw off 1 gallon of water and make a paste with the starch. Boil the 2 gallons of water, add the sugar-agar mixture. When clear add the starch paste solution, and cook for 3 minutes. To the stiff meringue above (1) add this hot mixture and beat up until cool enough to handle. This mix may be used to make cream pies, with the addition of color and flavor. It may be mixed also with acid-tasting fruits.

FRUIT BARS

Cake Crumbs	6	lb.
Molasses	1½	qt.
Water	2	qt.

Soak until soft, and then cream up.

Sugar	4	lb.
Malt Syrup	2	lb.
Shortening	3	lb.
Soda	6	oz.
Salt	1	oz.
Ginger	½	oz.
Cinnamon	1	oz.

Mix the two parts and add

Raisins or Currants	5	lb.
Coconut	2	lb.
Flour	11	lb.

Scale off in 12-ounce pieces and roll out in long strips. Lay four strips on pan, flatten, and bake in medium oven. These bars may be iced with water icing after baking, or washed with egg before baking, and left plain.

Cut into 1-inch slices when cool. The fruit may be omitted and many sorts of cookies made out of this mixture.

APPLE SAUCE CAKE

Cream		
Brown Sugar	1	lb.
Shortening and Butter	1½	lb.
Salt	⅛	oz.
Cinnamon, Allspice, Mace, and Cloves	¼	oz.
Add		
Molasses	12	oz.
Malt Syrup	1½	lb.
Milk	1½	pt.
Sift and add		
Bread Flour	2¼	lb.
Cake Flour	2	lb.
Baking Powder	2½	oz.
Add and mix in		
Ground Apples	2	lb.
With flour	8	oz.
Add		
Currants	1½	lb.
Walnuts	4	oz.
Chopped Cherries	1	lb.
Candied Grapefruit	4	oz.
Lemon and Orange Peel	2	lb.
Seeded Raisins	2	lb.

Bake in loaf cake tin at 350° F.

CHERRY LOAF

Cream		
Sugar, Fine Granulation	1½	lb.
Shortening	1	lb.
Salt	⅛	oz.
Cherry Flavor	¼	oz.
Add		
Egg Whites (Unbeaten)	1	lb.
Add		
Milk	1	lb.
Add		
Maraschino Cherries (Cut up)	1	lb.
Walnuts	¼	lb.
Sift and add		
Cake Flour	2½	oz.
Baking Powder	1½	oz.

Bake in loaf tins at 375° F.

LIGHT FRUIT CAKE

Cream together

Sugar	2 lb.
Shortening	2 lb.
Salt	1 oz.
Flavor	½ oz.

Then cream in

Eggs	2 lb.

Next add

Flour	2 lb.
Baking Powder	¼ oz.

Blend flour and baking powder.
Lastly add

Almonds	1½ lb.
White Raisins	2 lb.
Citron	2 lb.
Glace Cherries	2 lb.
Glace Pineapple	1½ lb.

Scale into loaf tins and bake at slow heat.

POUND CAKE

Cream together

Sugar	4 lb.
Butter or Shortening	2⅛ lb.
Milk Powder	4 oz.
Flour (Short Patent)	1 lb.

Add

Eggs	2½ lb.
Salt	½ oz.
Flavor	To suit
Invert Syrup	2 oz.

Add

Milk	1 lb.

Add

Flour	3 lb.
Baking Powder	½ oz.

Blend together flour and baking powder.
Then add

Milk	½ lb.

For fruit pound cake, half of the short patent flour should be bread flour. Add about 4–6 pounds of fruit. The fruit should be dusted with about ½ pound bread flour. Bake in wood-lined pound cake tins, 300°–325° F.

GINGER COOKIES

Sugar	2 lb.
Malt Syrup	1 lb.
Shortening	1 lb.
Molasses	1 qt.
Soda	2 oz.
Ginger	1 oz.
Salt	½ oz.
Flour	6 lb.

Cut with 3-inch cutter, and dampen with water. Bake in medium oven.

GINGER SNAPS

Sugar	4 lb.
Malt Syrup	1 lb.
Shortening	30 oz.
Molasses	2 qt.
Water	1 pt.
Soda	2½ oz.
Ammonium Carbonate	½ oz.
Flour	12½ oz.

Cut with 2½-inch cutter and bake in medium oven. These snaps should be washed with an egg wash before baking, or baked in light steam.

HONEY CAKES

Sugar	½ lb.
Shortening	½ lb.
Honey	1 qt.
Malt Syrup	1 lb.
Molasses	1 pt.
Ammonia	1 oz.
Soda	Pinch
Salt	½ oz.
Flour	To make medium dough

Let stand in cool place after mixing, to age for an hour or so, bake in medium oven.

OAT MEAL COOKIES

Sugar	6 lb.
Malt Syrup	2 lb.
Shortening	4 lb.
Eggs	14
Milk	1½ pt.
Soda	3¼ oz.
Rasins (Ground)	2 lb.
Flour	8 lb.
Oats (Rolled)	4 lb.
Salt	1 oz.
Cinnamon	1 oz.

Cut with 2½–3-inch cutter, wash with egg wash, and bake in medium oven.

JELLY ROLL

Sugar	2¼ lb.
Malt Syrup	4 oz.
Shortening	¼ lb.
Egg Yolk	1½ pt.
Milk	1½ pt.
Flour	3 lb.
Baking Powder	1 oz.
Ammonium Carbonate	½ oz.
Salt	½ oz.

This makes a jelly roll or marshmallow roll of good keeping qualities. If a chocolate roll is desired add a paste made of 8 ounces of cocoa and water to make a thick paste.

YELLOW MIX

Sugar	6 lb.
Malt Syrup	1½ lb.
Shortening	3 lb.
Milk	3⅓ qt.
Egg Yolk	1 qt.
Baking Powder	3¼ oz.
Ammonium Carbonate	1 oz.
Flour	11 lb.
Salt	1½ oz.

This is an excellent formula for layers, sheet cakes, and loaf or wine cakes, scale from it. By the addition of a little hard wheat flour and a little more baking powder, jumbles, drop cakes, and a wide variety of small cakes can be run with a pastry bag. The variety is unlimited.

BUTTERMILK COOKIES

Sugar	3½ lb.
Malt Syrup	½ lb.
Shortening	1 lb.
Eggs	15
Soda	3 oz.
Sour or Buttermilk	2 qt.
Flour	7 lb.
Salt	1 oz.
Lemon Flavor	

Drop on greased and dusted pans, bake in hot oven.

DEVIL'S FOOD

Formula No. 1

Sugar, Powdered XXXX	1¾ lb.
Malt Syrup	4 oz.
Shortening	1 lb.
Eggs	6
Sour Milk	3¼ pt.
Milk	¾ pt.
Soda	¾ oz.
Flour	2 lb.
Cocoa	5 oz.

Sift the flour and cocoa together. Can be baked in layers or sheets, and iced with chocolate or marshmallow icing.

DEVIL'S FOOD (Layers or Sheets)

No. 2

Cream together	
Sugar	10 lb.
Shortening	4 lb.
Salt	2 oz.
Soda	2 oz.
Cocoa	1½ lb.
Then add	
Eggs	6 lb.
Vanilla Flavor	To suit
Add mixed together	
Water	2 lb.
Condensed Milk (Sweetened)	4 lb.
Invert Syrup	¾ lb.
Sift together and add	
Flour	9 lb.
Baking Powder	2 oz.
Then add	
Water	2 lb.

Bake at 350°–375° F.

DEVIL'S FOOD (Layers, Cups, and Sheets)

No. 3

Cream together	
Sugar (Fine Granulation)	9 lb.
Shortening	3½ lb.
Salt	2 oz.
Vanilla	2 oz.
Add slowly	
Eggs	4 lb.

Then add	
Milk	4 lb.
Add mixed together	
Flour	10 lb.
Baking Powder	5½ oz.
Add paste of	
Sift Cocoa	2 lb.
Sugar	2 lb.
Soda	¼ lb.
Add	
Cold Water	4 lb.

Bake at 350°–375° F.

CHOCOLATE DOUGHNUTS (PLUNGER MACHINE)

Cream together	
Sugar	6 lb.
Shortening	¾ lb.
Cocoa	1¼ lb.
Salt	3 oz.
Vanilla	2 oz.
Add	
Eggs	3 lb.
Then add	
Milk	10 lb.
Sift together and add	
Bread Flour	5 lb.
Cake Flour	8 lb.
Baking Powder	½ lb.

Fry at 385° F.

DOUGHNUT GLAZE

(1) Granulated Sugar	1 lb.
Agar	3 oz.
Water	1 qt.
Vanilla	If desired

Mix sugar and agar, and boil for 3 minutes in 1 quart of water.

(2) Mix smooth 10 pounds of powdered sugar with 1 quart of hot water.

Pour hot (1) over (2) and mix thoroughly.

PAN COAT GREASE

Shortening 103° F.	4 oz.
Flour	1 oz.

Mix the above ingredients to a smooth paste. Apply on pans.

CAKE SPICE MIXTURE

Allspice	⅜ lb.
Nutmeg	⅜ lb.
Ginger	⅜ lb.
Mace	¾ lb.
Cloves	¾ lb.
Cinnamon	2¾ lb.

GELATIN AND EGG WHITE MARSHMALLOW POWDER

Granulated Sugar	3 lb.
Gelatin Powder	2½ oz.
Powdered Egg Albumen	½ oz.
Vanillin or other flavor	To Suit

Beat the above amount up with 1 quart of warm water, using second or third speed. If too stiff, dilute with more water. Color may be added, while beating. Marshmallow can be used in filling cream rolls, layer cakes and tarts. If desired, corn syrup up to 1 pound can be added and beating continued in third speed.

MERINGUE POWDER

Formula No. 1

Powdered Egg Albumen	50 lb.
Powdered Skimmed Milk	22 lb.
Fine Granulated Sugar	28 lb.
Gelatin Powdered	2 oz.
Vanillin	3 oz.

Formula No. 2

Powdered Egg Albumen	65 lb.
Tapioca Flour	20 lb.
Fine Granulated Sugar	10 lb.
Citric Acid Powdered	5 oz.
Vanillin	3 oz.

Formula No. 3

Powdered Egg Albumen	35 lb.
Fine Granulated Sugar	30 lb.
Corn Sugar	30 lb.
Gum Karaya	5 lb.
Vanillin	3 oz.

Eight ounces of any of the above meringue powders are sifted into 1 quart of water. Beat well, then add gradually 3½ pounds of sugar, and whip until stiff.

STABILIZERS—For Dry Fruit Fillers

To be used with wet fruit (by pouring over or combining) for holding shape and prevention of leakage.

Formula No. 1

Granulated Cane Sugar	40 oz.
Citric Acid	1 oz.
Salt	2 oz.
Corn Starch	60 oz.
Color and Flavor	If desired

Formula No. 2

Granulated Cane Sugar	30 oz.
Citric Acid	1 oz.
Salt	2 oz.
Tapioca Starch	15 oz.
Corn Starch	50 oz.
Color and Flavor	If desired

The above stabilizers can be used as glace for fruit tarts and fresh-fruit open pies. Use enough fruit juice out of a quart to mix up with 6¼ oz. of Formula 1 or 2. To the balance of the (quart) juice, in a kettle, add 6 oz. sugar, boil to 185° F.; then stir in the cold mixture, cook until thick and clear.

Shut off the heat, then add 7 oz. sugar, ½ oz. lemon juice, stir. Brush over fruit tarts while still hot, or pour over berry pies, etc.

MARSHMALLOW TOPPING (Made in Upright Vertical Beater)

Corn Syrup	200 lb.
Water	3 lb.
Powdered Albumen	2 lb.
Vanillin Flavor	To suit

Place 5 pounds of cold corn syrup in the bowl of the mixer. To this add the powdered egg white. Cream in low speed for about one minute until the egg white is dissolved. Then add the water, whip in high speed, until a good body is produced.

Now add slowly the corn syrup (which has been cooked to 240° F.) and whip in high speed to the desired peak. Add vanillin last. Part of the corn syrup can be replaced with invert or cane sugar syrup.

MARSHMALLOW TOPPING (Made in Horizontal Type Beater)

Corn Syrup	200 lb.
Water	5 lb.
Powdered Albumen	3 lb.
Vanillin Flavor	To suit

Cook corn syrup to 240° F. and transfer to horizontal type beater. Be-

fore starting beater, add the powdered albumen directly to the hot syrup, along the back side of the beater. Cover the machine, and heat for ½ to ¾ minute, then add very slowly the above amount of cold water. Beat to the right peak. Part of the corn syrup can be replaced with other syrup.

MARSHMALLOW

Granulated Sugar	12 lb.
Water	3 qt.
Powdered Tartaric Acid	¼ oz.
Powdered Egg Albumen	4 oz.
Gelatin	4 oz.
Vanilla Extract	¼ oz.

Cook the water and sugar to 235° F. Now add the acid and cook to 240° F. (This will invert the sugar, keep the marshmallow soft and prevent crystallization.) Dissolve the gelatin in one quart of hot water. Whip the albumen to a stiff meringue with 8 oz. of water. Pour the boiled syrup into the meringue and start whipping again. Slowly pour in the gelatin and whip until light, add vanilla flavor last.

BASIC FONDANT CREAM

Granulated Sugar	75 lb.
Corn Syrup	15 lb.
Nulomoline Syrup	10 lb.

This fondant can be stored without drying out. Add 5 gallons of water, and the sugars to the kettle and boil rapidly to 238° F.–248° F. Cool to 110° F.–125° F. and beat into fondant.

MARSHMALLOW FILLER

Formula No. 1

Granulated Sugar	100 lb.
or	
Sugar	50 lb.
and	
Heavy Glucose	50 lb.
Tartaric Acid	2 oz.

Boil in a kettle, with the precautions given under Fondant.

In the meantime beat up

Albumen	3 lb.	And add gradually
Water	6 qt.	
XXXX Sugar	15 lb.	

Add the beaten sugar albumen to the boiling syrup and let the stirrer go at high speed. Then add a mixture of

Powdered Gelatin	1 lb.
Cornstarch	3 lb.

which have been previously well mixed. Add some vanilla or any other desired flavor and continue to work machine until the desired consistency is reached.

To make marshmallow paste leave out the filler—the 3 pounds of cornstarch.

Formula No. 2

Boil to 240° F.

Cane Sugar	100	lb.
Corn Syrup	25	lb.
Water	25	lb.
Invert Syrup	30	lb.

Beat until stiff and then beat into the above hot mixture:

Egg White	20	lb.
Cream of Tartar	¼	oz.

Then dissolve 1 pound of gelatin in 5 pints of hot water, add to the above sugar-egg white mass, and then beat until stiff. Add vanilla just before finishing the beating.

Formula No. 3

Boil to 240° F.

Cane Sugar	100	lb.
Corn Syrup	12	lb.
Water	5	gal.
Invert Syrup	20	lb.

Beat until stiff and then beat into the above hot mixture:

Egg White	25	lb.
Cream of Tartar	¼	oz.

Then dissolve 20 ounces of gelatin in 5 pints of hot water, add to the above sugar-egg white mass, and then beat until stiff. Add vanilla flavor just before finishing the beating.

MARSHMALLOW STOCK FOR CREAM FLUFF FILLING

Boil to 250° F.

Granulated Sugar	10	lb.
Corn Syrup	2	lb.
Water	3	pt.
Cream of Tartar	¼	oz.

Beat for 2 minutes at high speed. Then add above hot syrup quickly to the following beaten egg white and beat stiff.

Egg White (Do not beat too stiff)	2	lb.
Vanilla Flavor	¾	oz.

Then add 2 ounces of gelatin previously dissolved in 6 ounces of hot water and beat 2–4 minutes. Remove from bowl and allow to cool. This is called STOCK.

MARSHMALLOW

CREAM FLUFF FILLING (To Prepare)

Cream until light (medium speed)

XXXX Powdered Sugar	8 lb.
Shortening	6 lb.
Butter	2 lb.
Powdered Skimmed Milk	2 lb.

Add slowly to the above the following and cream in well:

Whole Eggs	20 oz.
Vanilla Flavor	2 oz.

Now add the following to the above and cream in well:

Stock Marshmallow	8 lb.

Now add very slowly (medium speed) the following and then continue to cream at medium speed for 2–3 minutes after it is added:

Cold Water	4 pt.

EGG WHITE MERINGUE

Egg Whites	2 qt.
Granulated Sugar	6 lb.
Agar-Agar	2 oz.
Water	3 qt.

Sprinkle pinch of salt over egg whites and beat until dry.

Mix the sugar and the agar. Add this mixture to the boiling water and boil for 3 minutes.

Add this hot mixture slowly to the beaten egg whites, beating slowly all the time. Do not add the hot mixture faster than the egg white takes it up.

Fresh fruit such as prunes, apricots, peaches may be added to the above meringue for a fruit whip pie. Baking is unnecessary. Fruit juice may be used instead of water in cooking the agar.

IMPROVING WATER ICINGS:

Water icings are made by mixing sugars with water. These icings are in general use and illustrate the importance of using different classes of sugars and methods of manipulation. Consistency (coherence and firmness—the ability to be spread and to stay put) and finished results are not just a matter of proportions of ingredients. They are determined,

also, by the properties of the materials used and the way in which they are put together.

In the preparation of icings, the water dissolves some of the sugar crystals (and some sugar from the surface of the other crystals) to form a syrup which surrounds and holds together the other particles. When powdered sugar is mixed with cold water, it forms plain water icing which is short, semi-transparent and has little gloss. Because cane and beet sugars are natural driers, they force the water to evaporate quickly and, therefore, plain water icings rapidly become dry, hard, brittle, cracked and spotted. This also occurs in all other icings unless proper precautions are taken to prevent their occurrence. In order to produce body, opaqueness, gloss and other desirable qualities in a water icing, it is only necessary to make a few changes in the basic formula and process.

Powdered cane and beet sugars, ground for icing purposes, usually contain small percentages of starch which gelatinize when heated with water. More sugar dissolves in a given quantity of hot water than in a like amount of cold water. These facts may be used to change the characteristics of plain water icings and other varieties. By using hot water, or by heating the plain water icing, the starch is caused to swell and more sugar dissolves, increasing the opaqueness and gloss.

When greater opaqueness and more gloss are desired, a small percentage of fat may be added, to whiten the icing during creaming and make it shiny when used. For more body and quicker set, replace part or all of the water with egg white, or dissolve (in each pound of water used) from ½ to 1½ ounces of egg albumen or gelatin, the egg white and gelatine "thicken" the syrup and "set" during cooling and drying. In order to overcome brittleness, cracking and peeling and to retain softness and freshness, use about 1½ ounces of Nulomoline to every pound of icing; this controls sugar crystallization and retains moisture.

THE ADVANTAGES OF FONDANT:

When finer crystals, more smoothness and higher gloss than can be obtained with the most finely powdered sugar are desired, a fondant is made. Non-grittiness is produced by forcing the sugar to form very tiny crystals while the fondant is being made. The ratio of sugar to water in finished water icings and in fondants is practically the same; seven sugar to one water. However, in the icing the remaining particles are comparatively large, whereas in making the fondant, all the sugar is first dissolved and the crystallization controlled to form extremely fine granules.

Fondants are made by controlling the heat, first to dissolve an excess of sugar and then to cause the extra sugar to form fine crystals. Enough water is used to dissolve all the sugar (about one to three) and the extra

water is boiled off by cooking the mixture to 236 to 244 degrees F. The cooked syrup for fondant is then cooled to about 90 to 110 degrees F., after which it is "creamed," beaten or agitated. During creaming, part of the sugar dissolved in the syrup crystallizes, the rest being retained. If only cane or beet sugars are used and the syrup is creamed at the wrong temperature, coarse grains are formed and the fondant is of poor quality. However, if Nulomoline is used in making the syrup, it checks the syrup from graining during cooling and before creaming, but forces the sugar to form extremely fine crystals while the syrup is being creamed to make fondant. Fondants are kept tender and soft by including about one pound of Nulomoline in each ten pound batch of syrup.

The beating or "creaming" may be done by hand, in a cake machine, or (preferably) on a special fondant beater. The proper production of fondant requires special equipment and skilled operators. It is advisable that bakers buy their fondant from supply houses who usually offer an excellent product at a reasonable price. It is usually more economical and satisfactory to buy fondant than make it under average bake shop conditions.

Fondant can be used to replace equivalent proportions of sugar and water in almost all ordinary icings for improvement in quality. Moreover, fondants should be used as a base in making many varieties of high quality icings—with the addition of fats, eggs, gelatin, flavors, colors, etc., many varieties of fat, light and fluffy icings can be developed.

HANDLING SUGAR AND WATER IN COLD-AND-HOT-PROCESS ICINGS:

The size of the sugar crystals influences the speed at which they dissolve in water, but does not influence the amount that can be dissolved in a given quantity of water. One pound of water dissolves two pounds of granulated or powdered sugar at 63 degrees F.; larger amounts of sugar dissolve when the temperature rises. For example, if a pound of water is heated in three pounds of sugar at 147 degrees F., the sugar dissolves completely. At 189 degrees F., a pound of water will dissolve four pounds of sugar. Thus, a syrup at 189 degrees F. can hold in solution twice as much sugar as a syrup at 63 degrees F. However, the additional sugar will not remain in the syrup but will crystallize out, until at room temperature (about 65 degrees F.) the ratio between sugar and the water will reach 2:1. As the water evaporates from the icing syrup, the dissolved sugar crystallizes out, forming larger and coarser grains. Therefore, Nulomoline is used in icings to check drying and force the sugars to form fine crystals.

TRACING WHAT HAPPENS TO THE SYRUP AND SUGAR IN ICINGS:

When icings are freshly made, they usually contain much more water than remains after the iced cookies are put on display or packed in caddies or packages. The icings on cookies contain only about twelve percent or less moisture, just sufficient to make an icing of stiff fondant consistency. This water holds about twice as much sugar in solution (24%); the rest of the sugar is in crystal form (64%).

However, if an icing is made solely with 12 pounds of water and 18 pounds of sugar, it is too stiff for icing either by hand or machine. For softer consistency, more water is needed, and icings are often made with up to 22 pounds or more of water.

Icings with 22 pounds of water have 44 pounds of sugar in solution and only 34 pounds in crystal form. The extra 20 pounds of sugar (which were not dissolved when less water was used) dissolve in the extra ten pounds of water. Afterwards, the extra sugar crystallizes out as the water evaporates from the icings during surface-drying. Some of the extra 20 pounds of sugar forms new crystals but much of it adds onto and enlarges the crystals comprising the original 34 pounds. These enlarged crystals make icings hard and gritty and produce dull appearance. Moreover, these large sugar particles grow even larger in size when icings continue to dry more than is desirable.

To secure smoothness and gloss, excess drying must be checked and sugar crystallization must be controlled. These are the functions for which Nulomoline is especially advantageous. The maximum levulose content of Nulomoline attracts and holds moisture; it retains the proper water content in finished icings and keeping them pliable and fresh. Also, the levulose has a remarkable influence in increasing the total amount of sugars which remain in solution and in retarding the crystallization of other sugars. Nulomoline, therefore, produces icings with finer crystals, more gloss and much smoother eating qualities.

The same precautions should also be taken with all other kinds of icings. Therefore, about ten pounds of Nulomoline should be added to each hundred pound batch of icing to retain softness and freshness.

CONTROLLING THE MOISTURE CONTENT OF ICINGS:

The time required for an icing to set or become surface-dried, so that it can be handled and wrapped, depends considerably upon its moisture content. Icings with less water set more quickly; therefore, it is good practice to use the least amount of water possible. Flat icings (e.g., plain water icings and fondant) should contain about 12% of water; those

with large amounts of fat (e.g., butter creams) should contain less; and those with water-absorbing materials (e.g., cocoa) more. Fluffy icings, lightened with gelatine or eggs, should contain a total of 16 to 22% of water.

CHANGING THE CONSISTENCY OF ICINGS:

If flat icings do not handle easily, it is usually better to change their consistency by adding a simple syrup (made by dissolving two pounds of sugar in one pound of water) or by keeping the icings warm, rather than by adding water. When icings are warmed, the syrup and fats become more fluid, allowing the sugar crystals to slide by each other more easily. Of course, fluffy icings lightened by shortening cannot be heated without losing volume, but practically all others can be warmed up to as high as 110 degrees F., or kept warm to make spreading easier.

For "dipping icings," any flat icings (e.g., water icing or fondant) can be used. Add sufficient simple syrup (made of two pounds of sugar dissolved in one pound of water) to make the icings thin enough for dipping purposes. (Warming the icing to about 100 degrees F. also thins it.) Warmed icings need less or no extra syrup for thinning and, consequently, set more quickly and require less time for surface-drying.

MAKING CHOCOLATE ICINGS (FUDGE AND OTHERS):

Chocolate fudge is one of the most popular cake icings. For exceptional quality it should be made according to a candy maker's procedure and with the same ingredients that he uses. The fat in block chocolate (which is hard at temperatures below about 85 degrees F.) must be kept warm or softened while it is being incorporated in icings, so that hard lumps do not form. Also, the chocolate should be made plastic so that it will be workable for spreading on a cake and remain soft afterwards to prevent hardening and cracking on the cake. The final color of chocolate icings depends considerably upon the temperature of the batches at the time they are used. The color of chocolate icings darkens when batches contain extra fat and are warm. The starch and vegetable fibres, which naturally form a large percentage of chocolate, slowly soak up and swell when water is present, particularly if heated. This swelling produces body and smoothness.

The nature of chocolate brings up a few problems, which should be considered when selecting the other ingredients and procedure to be used in a chocolate fudge icing. A "fudge" icing should have characteristic candy-like richness and eating qualities. Much of the richness can be secured from butter, which is soft at ordinary temperatures. Therefore, if butter is mixed with the firm fat naturally contained in chocolate (un-

sweetened chocolate is about half cocoa butter, which is hard and brittle), the icing will be soft while being used.

In addition to chocolate and butter, two other ingredients are needed to complete the icing—liquids and sugars. As the liquid ingredient, milk is preferable, as it imparts quick setting and non-sticky properties, particularly when cooked. The hazards of cooking milk are lessened by cooking it with butter, to prevent scorching and to cut down foaming. Moreover, when chocolate is heated in a cooking kettle, there is danger of its becoming scorched; and even slight burning destroys flavor and produces dark specks. This hazard can be eliminated by chipping the chocolate into small pieces and placing it in a mixing bowl by itself. Then it can be melted by pouring onto it hot syrup or hot fat that has been heated separately.

Sugars should be selected which produce the most desirable results; granulated sugars for economy, when it is to be dissolved, a very finely powdered (6X or 8X) icing sugar, when it is not to be dissolved. Nulomoline should be added to control grain in the cooked syrups when they are to be poured on the chocolate. It also retains moisture and prevents the final icing from drying, spotting and peeling, keeping it soft, glossy and fresh.

DEVELOPING FLAVOR DURING COOKING:

Icings, perhaps better than other products made by the baker, illustrate the fact that some pleasing flavors come from skillfully blended materials. The tantalizing goodness of caramel, butterscotch and "cream" fudge defies extraction by the flavor chemists. These appealing combinations are developed by the baker during actual icing production.

Caramel flavor is developed by making two changes in a cold-process icing consisting of powdered sugar and water. First, the water is replaced by milk and part of the powdered sugar with brown sugar. Secondly, the sugar and milk are cooked in order to develop the universally appealing flavor of caramel. When butter is used instead of milk, the inimitable flavor of butterscotch is secured. By cooking together the three ingredients (sugar, milk and butter), the rich flavor of "cream" fudge is brought out. By adding chocolate, chocolate fudge is produced. Chocolate and caramel combined form milk chocolate.

Sweetened condensed, evaporated and dry milks have a milk-caramel flavor which is acquired while these materials are being made. They can be used to advantage in caramel and fudge icings. Tricol (a flavor processed sweetner for balanced flavor, color and sweetness) has an exquisite, uniform, sugar-caramel flavor, and is an exceptionally good product to use in caramel and butterscotch icings.

ELIMINATING STICKINESS IN ICINGS:

Some materials, when they are dissolved in or moistened by water, become sticky, whereas others do not. Stickiness in icings may be overcome by tying up the water with materials which will make non-sticky "prepared syrup bases." These non-sticky prepared bases, when mixed with dry materials such as powdered sugar, produce icings which can be wrapped almost immediately.

Bakers are familiar with the fact that when starches are gelatinized, they take up large amounts of water and form stiff gels; likewise, agar-agar (Japanese gelatin) sets up water. When these starch and agar-agar bases are used instead of water, they induce the growth of micro-organisms with consequent spoilage of icings and cakes. However, spoilage in prepared bases can be prevented by including in them the maximum content of sugar (sugar in high concentration acts as a preservative). Each pound of water used in a prepared base should have dissolved in it at least two pounds of a combination of Nulomoline and sugar. This large amount of sugar and Nulomoline, while acting as a preservative also prevents starch from forming too stiff gels. Thus, the high sugar-and-Nulomoline content also allows the inclusion of sufficient starch to offset excess sweetness, without causing too much stiffness that would make difficult the incorporation of the prepared base in the icing. Well balanced icings contain properly prepared syrup bases and the necessary amounts of Nulomoline to keep them soft and pliable and to prevent them from drying, cracking and peeling.

ADDED "BOTTLED" FLAVORS:

The almost unlimited number of bottled flavors which are available offers every baker the possibility of achieving individuality through resourceful blending and care in incorporation. Vanilla and lemon flavors are good but are often thoughtlessly dashed into too many batches, resulting in the frequent complaint that "all bakery goods taste the same."

Bottled flavors are highly concentrated and should be handled with extreme care. The exact amount needed to produce elusive pleasantness should be determined, carefully measured and thoroughly distributed to avoid over-flavored parts of the icings.

Inaccuracies caused by using concentrated flavors are lessened by diluting them so that the least amount taken for any one batch is an ounce or more. The dilutions often can be made with water but the flavors are less likely to spoil if diluted by using them in a special emulsion. An emulsion is also useful in combining two or more concentrated flavors into one diluted flavor for special icings or cakes.

MAKING LIGHT-FLUFFY ICINGS:

The principles which have been discussed about the functions of ingredients, influence of heat and use of flavors apply to light-fluffy icings, as well as they do to flat icings.

Perhaps the most important difference between light-fluffy icing, and flat icings, is in the size of the finished product. Light icings make cakes look larger. The increase in the bulk alters the consistency and makes the icing operation easy.

When butter and creaming fats (such as hydrogenated vegetable shortening) are creamed with powdered sugar, they take on air. In these "butter creams," whole eggs, egg yolks or egg whites are sometimes included for the smoothness and body which they add. Moreover, yolks contain considerable lecithin, which makes water mix more readily with fat; by creaming yolks with butter or shortening, an emulsion is formed which produces smoother, more permanent icings. When egg whites are used, they are creamed along with the other ingredients (just as whole eggs and yolks) or whipped separately with syrup to make marshmallow that, in turn, is added to the creamed portion.

Egg whites are used without fats to make light icings. For cold-process, fluffy icings, either dried egg white (egg albumen) that has been dissolved or whole egg white is simply beaten with icing sugar; for Royal icings, about six pounds of icing sugar are added for each pound of egg white. However, for light-fluffy boiled icings a hot process is used; a syrup is poured onto egg white or dissolved egg albumen, while it is being beaten. This syrup is made by dissolving the sugar in an excess amount of water. The extra water is then boiled off by cooking to a definite temperature. The crystallization of the sugar is controlled with Nulomoline in order to form a smooth fine grain in the finished icing.

Under "boiled icings" are classified many different varieties made by heating the ingredients used in their production; but the term "boiled icing" is often used in reference to only one particular group—the light-fluffy icings which are similar to the "seven minute" or "Lady Baltimore" icings made by housewives, when they whip egg whites and sugar while warming them in a double boiler. Although these icings are popular in the home, they are seldom used by bakers because they frequently grain and become "sandy." However, this problem can be overcome by bakers if the characteristics of light-fluffy boiled icings are taken into consideration.

In one respect, light-fluffy boiled icings are a cross between fondant icing and marshmallow. Fondant consists of very fine crystals of sugar surrounded and held together by syrup (12% water and 88% sugars).

In fondant there is not enough water to dissolve all the sugar, but in marshmallow there is considerably more (28%), holding in solution all the sugars (68%). Marshmallow, then, is syrup which is aerated with about 2% of egg white solids or gelatin.

The water content of boiled icings 20% is about half-way between that of fondant and marshmallow. From this point of view, a light-fluffy boiled icing is somewhat like marshmallow into which icing sugar has been stirred. However, the granules of icing sugar are much coarser than those in fondant or in well-balanced, properly made, light-fluffy boiled icings.

A light-fluffy boiled icing is an aerated syrup in which sugar crystals are suspended. This is what is produced when a housewife beats warmed sugar and egg whites. The 20% water contained in the 24% egg white first dissolves about 40% sugar at 63 degrees F.; gradually more and more sugar is dissolved as the beating is continued and the temperature rises (about 60% sugar is dissolved at 147 degrees F.). However, at about 140 degrees F. the egg whites start to coagulate (become cooked), the icing becoming stiffer and acquiring a pleasing taste. The sugar which is dissolved at high temperatures recrystallizes as the icing cools and these crystals remain suspended in the icing. The crystals must be kept extremely small in order to make smooth, glossy, boiled icings.

If the baker is equipped with a mixing bowl that can be heated, boiled icings can be made in the same way that "seven minute" icings are made at home. These must be made in small batches and used quickly to prevent the sugar which recrystallizes during cooling from forming large grains, thereby producing sandiness.

A more convenient way to make boiled icings is to heat the sugar separately from the eggs. By making a hot syrup, considerable sugar can first be dissolved and then formed into extremely fine crystals while the icing cools. Moreover, the heat cooks the eggs, assuring stiffness and good taste.

Since water is required to make the hot syrup, a correspondingly smaller amount of eggs must be used. For example, if the egg whites are reduced to 15%, 7% water is used for making the hot syrup. This is enough to dissolve 53% sugar by cooking the syrup to 245 degrees F. This syrup plus the egg whites, totals 75% of the ingredients, which means that 25% sugar should be dissolved in the egg whites, by stirring the two together slowly for several minutes.

When making boiled icings, about one pound of Nulomoline should be added to each ten pound batch to control sugar crystallization. This prevents hot syrups from graining before they are poured into beaten egg whites and produces extremely fine crystals during the cooling of the

finished icings. When making boiled icings for wrapped cakes, some material which will prevent stickiness should be incorporated; (e.g., starch, agar-agar and gelatin, extra egg white solids using reconstituted dry albumen instead of fresh whites, or a water-absorbing gum) just before finishing the whipping.

Although icings made with egg albumen are more tender, gelatin is often used because it sets when cool and does not have the odor often associated with egg albumen. Both egg albumen and gelatin are prepared for use in a similar manner; usually one weight of egg albumen or gelatin is dissolved in two weights of water. The egg albumen is dissolved in lukewarm water (hot water causes coagulation which results in insoluble particles). Gelatin is soaked in cold water and then warmed until fluid (heating at over 140 degrees F. for long periods is injurious). The advantages of each are procured by using combinations of egg albumen and gelatin in icings. Commercial whip or meringue powders occasionally are such combinations.

Fats, egg and gelatin are all good materials with which to incorporate air into icing. If used with proper combinations of other ingredients, they produce superior light-fluffy icings.

MAKING MARSHMALLOW:

Marshmallow is often called light-fluffy icing, but there is an important difference between the two. Icings contain sugar crystals, whereas the sugar in marshmallow should be completely dissolved. In other words, marshmallow is syrup which has been aerated; the air which is beaten into the syrup is held by egg whites, egg albumen or gelatin. That this is a fitting definition is not as apparent when freshly made marshmallow is seen before it is beaten. A study of the marshmallow syrup batch before beating tells what will happen to the marshmallow afterward.

Marshmallow should stay, as long as possible, the way it is right after being freshly made and used. Therefore, the syrup must be such that it will not change on standing. It should be: (1) non-drying, (2) non-graining, and (3) non-fermentable.

If only cane or beet sugars are used in making marshmallow and sufficient water is used to keep these sugars dissolved, the marshmallow is fermentable and is likely to spoil. For safety, it is necessary not to have over thirty-two percent total water in marshmallow, and for fillings between layer cakes for non-soaking, not over twenty-five percent. These figures show that marshmallow made with only cane or beet sugar is bound to become sandy, as a part of these sugars will crystallize and form coarse grains.

However, freedom from graining and fermentation is easily secured by

having part of the sugar in the form of Nulomoline. It prevents the sugar used from crystallizing. Drying, which would cause graining and toughness, is retarded and the marshmallow is kept tender. Use from one to five pounds of Nulomoline in each ten pounds of hot or cold process marshmallow.

MAKING FILLINGS:

For cake fillings, use icings as they are or, if desired, or with flat and butter cream icings, adding a little extra water or extra prepared marshmallow to them before spreading. Extra light-fluffy "cream" fillings, somewhat similar to genuine whipped cream are modified butter cream icings which contain a high proportion of fats. In these it is preferable to use a combination of creaming shortening, butter and coconut fat for maximum stability and elimination of "greasy" taste (20–25% of the total batch weight is fat in imitation whipped creams in contrast to the 15% in butter creams). These imitation whipped creams are used to fill layer cakes, to fill sponge cups and fingers, to "spot" on sponge popovers and tarts and to sandwich soft cookies.

Although icings are sometimes used as fillings, icings usually are intended to become surface-dry. Consequently, icings contain only enough water to form a syrup which holds the fine sugar crystals together. In contrast, fillings can be sticky and, therefore, can contain much more moisture.

In fact, sufficient water can be used in fillings to dissolve all of the sugar and form a syrup. However, syrups alone are too soft and liquid for spreading in between layer cakes. But when the syrups contain one or more materials which cause them to stiffen, they hold the layers apart and do not allow excessive soakage. This describes the type of fillings which are discussed here, those which are "thickened-syrups."

Inasmuch as fillings contain considerable moisture, they are apt to spoil unless precautions are taken to prevent the growth of yeast, mold or bacteria. Fortunately, sugars are excellent preservatives, if they are present in sufficiently high concentrations—more than 67% and up to 80% for maximum safety from spoilage. Therefore, fillings should contain slightly more than two pounds of a combination of Nulomoline and sugar for each pound of water. However, one pound of water will not keep more than two pounds of cane or beet sugar in solution—the extra sugar required for preservation tends to crystallize out of the solution. When part of the sugar is Nulomoline, crystallization is checked and a greater amount is kept dissolved in a given quantity of water.

When making solutions of maximum concentration, a combination of about three pounds of Nulomoline for each one of granulated sugar

should be used. About one pound of water to dissolve each three pounds of sugar are then added and the solution is cooked at from 220 degrees (67%) to 230 degrees F. (80%), depending upon the final concentration desired.

Low concentration syrups (below 50%) are easily thickened but stiffening those of high concentration is a difficult problem. To solve it, numerous experiments with many thickeners were made in our testing bakery. Some of the facts concerning the results obtained are presented in the following paragraphs.

Pectin is perhaps the most effective and economical ingredient with which to stiffen high density syrups but is used only in making tart marmalades, jams and jellies. For jellies without tartness, agar-agar is valuable. Although gums (Karaya, tragacanth, locust bean) are expensive and only form soft pastes, they are advantageous sometimes when used along with other thickeners. Milk and eggs "custardize," or thicken, when cooked and are very useful except when their fat content prevents the fillings from being whipped light and fluffy. The proteins in flour coagulate and form objectionable lumps. Although small proportions of starches form very stiff pastes in solutions of low concentration, a greater amount forms only soft pastes in syrups of high concentration. Gelatin not only "sets" syrups but also aerates them when beaten.

Competent authorities recognize that the properties of thickeners are complex and can be understood fully only by working with them. This becomes evident especially when starch and gelatin are used together; their properties supplement one another and results not obtainable otherwise can be secured with such a combination.

ICING PASTE OR CREAM BASE

XXXX Sugar	60 lb.
Corn Syrup	30 lb.
Glycerin	8 lb.
Shortening 110° F.	2 lb.

The above ingredients are all melted down by means of heat. Stir thoroughly with agitator until thoroughly cold. The addition of color and fruit flavor will then yield the desired fruit flavored icing cream. Where a chocolate icing is desired, add cocoa powder.

VANILLA ICING

XXXX Powdered Sugar	30 lb.
Vanilla Bean Extract	3 oz.
Corn Syrup	1 lb.
Hot Water	4 pt.
Egg White	14 oz.

Prepare in same manner as for icing pastes.

CHOCOLATE ICING

XXXX Powdered Sugar	24 lb.
Coconut Butter (Melting Point 86° F.)	1 lb.
Invert Sugar Syrup	2 lb.
Bitter Chocolate	4 lb.
Hot Water	2 pt.

Prepare in same manner as for icing pastes, but melt the chocolate and coconut butter first.

CHOCOLATE FUDGE ICING

Formula No. 1

Boil to 230° F.

Granulated Sugar	8 lb.
Water	2½ pt.
Salt	¼ oz.

Shut off steam and then add

Invert Sugar Syrup	2 lb.
Bitter Chocolate	4 lb.

Stir until smooth, then transfer to machine bowl and at low speed sift in 3 pounds of XXXX powdered sugar. Keep mixing and when it starts to stiffen add 1½ pounds of shortening, ½ pound of butter, and ½ ounce of vanilla flavor. Mix well.

CHOCOLATE FUDGE ICING

Formula No. 2

Bitter Chocolate	5 lb.
Shortening	4 lb.
Corn Oil	8 oz.

Warm above mixture to a uniform paste.

Water	2 qt.
Agar-Agar	3 oz.
Corn Syrup	3 lb.
Cane Sugar	1 lb.

Mix the sugar with the agar-agar, and then add slowly to the boiling water, then add the corn syrup. Boil for 5 minutes on a slow flame. Transfer to mixing bowl, add the bitter chocolate, shortening, and corn oil, and mix smooth in machine. Now add 18 pounds of powdered sugar, beat again until smooth. Flavor and color if desired.

LEMON ICING

XXXX Powdered Sugar	30 lb.
Lemon Juice	½ lb.
Corn Syrup	1 lb.
Hot Water	4 pt.

Add the above ingredients to the hot water and mix together in the machine.

ORANGE ICING

XXXX Powdered Sugar	30 lb.
Orange Juice	1 lb.
Corn Syrup	1 lb.
Hot Water	4 pt.

Prepare in same manner as above.

NON-STICKY CHOCOLATE ICING

Water	2 pt.
Agar-Agar	1 oz.
Granulated Sugar	3½ lb.
Corn or Invert Syrup	2 lb.
Bitter Chocolate	1½ lb.
Shortening	2 lb.
Icing Sugar	10 lb.
Vanilla Flavor	To suit

Soak the agar-agar overnight in the water. Add to the agar solution the granulated sugar and heat until dissolved. Shut off the steam and add the bitter chocolate, shortening, and stir until dissolved. Now add the corn syrup, icing sugar, flavor, and mix until smooth.

This icing is applied at 100°–110° F. Warm to this temperature when needed. If the icing becomes too heavy after being used several times, dilute with sugar syrup.

BUTTERSCOTCH ICING

Boil to 245° F.	
Brown Sugar	8 lb.
Butter	4 lb.
Water	4 pt.
Salt	2 oz.
Now cream up light	
XXXX Powdered Sugar	25 lb.
Shortening	5 lb.
Liquid Skimmed Milk	2 pt.

Into this creamed mass add the hot butterscotch syrup and whip up to the desired consistency.

BANANA ICING

Whip together	
Cake Flour	10 lb.
Shortening	20 lb.
Salt	12 oz.
Add to above	
Water	15 pt.

and mix well. Now add

Icing Sugar	100 lb.
Banana Paste	20 lb.

and continue whipping until icing is light.

WHITE FUDGE ICING

Heat to 160° F.

Liquid Skimmed Milk	3½ lb.
Butter	1½ lb.
Vegetable Shortening	1½ lb.

Add the above to

XXXX Powdered Sugar	18 lb.
Salt	¼ oz.

Mix until smooth, then add 2 ounces of vanilla extract.

CARAMEL ICING BASE

Water	7 pt.
Brown Sugar	20 lb.
Butter	5 lb.

Heat the above to 320° F., shut off steam, then whip in until smooth the following ingredients:

Granulated Sugar	16 lb.	Mix together and then make into paste with this water.
Powdered Skimmed Milk	4 lb.	
Water	10 pt.	

Where a darker icing is desired add caramel color.

SIMPLE BOILED ICING

Beat until stiff

Egg Whites	2½ lb.
Sugar	1 lb.
Salt	¼ oz.
Vanilla Flavor	To suit

Now cook to 236°–240° F.

Sugar	6½ lb.
Corn or Invert Sugar	½ lb.
Water	2 pt.

Add the hot syrup to the beaten egg white, slowly, with beating until stiff. Chopped nuts or fruits or any desired flavor may be introduced.

MARSHMALLOW ICING

Boil to 240° F.

Granulated Sugar	10 lb.
Corn Syrup	2 lb.

Cream of Tartar	¾ oz.
Water	1½ pt.
Whip up lightly	
Egg Whites	2 lb.

Then add hot syrup to beaten egg white, and beat up light. Now stir in

XXXX Powdered Sugar	3 lb.

and mix until smooth.

BUTTER CREAM ICING

Powdered Sugar	10 lb.
Powdered Milk	2 lb.
Salt	3 oz.
Shortening	5 lb.
Eggs	1 pt.
Vanilla Flavor	To suit

Mix up smooth in machine and then add 10 pounds of boiled meringue icing.

BOILED MERINGUE ICING

(1)	Egg Whites	2 pt.
	Meringue Powder	8 oz.
	Water	2 pt.
	Color and Flavor	
	Beat to a Mazette	
(2)	Powdered Agar-Agar	2¾ oz.
	Sugar	12 lb.
	Corn Syrup	3 lb.
	Cream of Tartar	1 oz.
	Water	2 qt.

Mix the sugar with the agar. Boil water, add cream of tartar, then add the sugar-agar mixture slowly, then the corn syrup and cook at least 10 minutes. Add this slowly to the above mazette and beat for 10 minutes in high speed.

LIGHT MERINGUE ICING

Beat until stiff	
Salt	¼ oz.
Vanilla Flavor	To suit
Egg Whites	10 lb.
Now boil to 240° F.	
Sugar	32 lb.
Corn Syrup	3 lb.
Water	10 pt.

Add the hot syrup to the beaten egg whites and beat to a good consistency. Chopped nuts or fruit juices may be added.

HEAVY MERINGUE ICING

Beat until stiff	
Egg Whites	10 lb.
Boil to 240° F.	
Sugar	45 lb.
Corn Syrup	12 lb.
Water	12 pt.
Salt	½ oz.
Vanilla Flavor	To suit

Add the hot syrup to the beaten egg whites and beat to a good consistency. Flavor, nut meats, fruits, or juices may be added.

BAKERS' STABILIZER "C" FOR MERINGUES*

DIRECTIONS

1. WITH FRESH OR FROZEN WHITES

Beat dry 2 quarts of egg whites in medium speed.
Boil for 3 minutes the following mixture:

Sugar	9 lb.
Water	6 pt.
Bakers' Stabilizer "C"	3–5 oz.

(The bakers' stabilizer should be mixed with part of the sugar before the water is added.)

Thread this hot mix into the beaten whites and beat for 5 to 10 minutes or until cool.

2. WITH DRY ALBUMEN

Whip stiff 16 to 20 ounces of albumen and 1 gallon of water.
Boil for 3 minutes.

Sugar	14 lb.
Water	9 pt.
Bakers' Stabilizer "C"	7½ oz.

(The bakers' stabilizer should be mixed with part of the sugar before the water is added.)

Thread this hot mix into the beaten whites and beat for 5 to 10 minutes or until cool.

3. The bakers' stabilizer may be used cold with either the frozen whites or dry albumen.

In such a case, the boiled stabilizer-sugar-water mixture is allowed to cool and the cold jell is threaded into the whipped albumen.

Two ounces of vanilla and 1 ounce of salt may be added for flavoring.

* Stein, Hall & Company, New York City.

BUTTERSCOTCH PASTE ICING

Butter	5 lb.
Brown Sugar	10 lb.
Skimmed Milk Powder	4 lb.

Make a solution of the milk with 6 pints of water.

Scorch the butter in a kettle, then stir in the brown sugar and heat to 260° F. To this hot sugar syrup, add the liquid milk, and cook up to 230° F., stirring briskly.

FONDANT BASE ICING OR FROSTING

Granulated Sugar	80 lb.
Corn Syrup	8 lb.
Water	20 lb.
Cream of Tartar	2 oz.

Cook above to 242° F. Cool to about 110° F., then stir in cake mixer until it becomes creamy and white. This base is put away, and when needed, warm slightly, but do not heat the fondant over 95° F. If fondant is too heavy thin down with simple syrup. This icing can be made up with chocolate, fruits and nuts. Always apply the icing warm.

CHOCOLATE FUDGE BASE

Bitter Chocolate	30 lb.
Cocoanut Shortening	25 lb.
Cocoa Powder	5 lb.
Glycerine	1 lb.
Corn Syrup	25 lb.
Vanillin Flavor	To Suit

Melt slowly chocolate, shortening, cocoa, glycerine. Heat to 150° F., then add the corn syrup.

BUTTERSCOTCH FUDGE

Corn Syrup	1 lb.
Brown Sugar	40 lb.
Skimmed Milk	20 lb.
Butter	5 lb.

Cook above to 240° F.

When cooled down to 150° F.

Add

Burnt Sugar Coloring	3 oz.
Skimmed Milk	10 lb.
Lemon Powder	1 oz.
Butter	5 lb.
Salt	2 oz.
XXXX Sugar	80 lb.

When ready to use warm to 110° F.

CUSTARD PIE—RICH AND NON-WATERING

Whole Milk Powder	30	oz.
Granulated Sugar	43	oz.
Corn Starch	10	oz.
Powdered Whole Egg	15	oz.
Salt	½	oz.
Nutmeg	5	g.

Work the above ingredients into a smooth batter with about 2 pints of water. Pour this into 8 pints of boiling water, stir until it thickens. Then bake in individual pie plates at 425° F. to 450° F., with good bottom heat.

FLAVORING EXTRACTS

These extracts consist of small percentages of true extracts, oils, or essences in a solution of alcohol. The chemical duplicates of natural flavoring extracts are usually called imitations. The aromatic characteristics of a great many spices, nuts, herbs, fruits and even flowers are sold, the best known ones being lemon, orange, cloves, cherry, cinnamon, anise, peppermint, pineapple, strawberry, vanilla, etc. Many natural essences are obtained by extracting the essential aromatic oil from the blossoms, fruits, fruit rinds, either by expression, absorption, distillation or maceration. The first method (that of expression) would be applied to citrus rinds, e.g., lemon, lime or orange. The second method (absorption) is generally applied by steeping in alcohol, e.g., vanilla beans. The third method (distillation) is accomplished by distilling, for example peppermint, in water. By the use of the fourth method (maceration) the raw material is simply allowed to soak in water or in a combination of water and alcohol long enough for soluble substances to be extracted. There are some artificial flavors that compare almost very favorably with the natural substance, e.g., vanillin and wintergreen. Terpeneless flavors are those which have had terpenes or hydrocarbon conponents removed from the essential oils. They are stronger, more easily soluble, longer lasting and, therefore, economical. They are, however, very costly and at times lack some of the richness of the original oil itself. All flavoring extracts should be transparent, free from any cloud, and should be able to stand on the shelves without becoming rancid, cloudy or unsaleable.

FLAVOR EXTRACTS

ALLSPICE EXTRACT—60% Alcohol

Pimento Oil	1	pt.
Alcohol	2	pt.
Water	¼	pt.

ANISE EXTRACT—72% Alcohol

Anise Oil	3 pt.
Alcohol	9 pt.
Water	½ pt.

BERGAMOT EXTRACT—58% Alcohol

Bergamot Oil	5 pt.
Alcohol	8½ pt.
Water	1½ pt.

BITTER ALMOND OIL—62% Alcohol

Bitter Almond Oil	2 pt.
Alcohol	5 pt.
Water	1 pt.

CARDAMOM EXTRACT—68% Alcohol

Cardamom Oil	2½ pt.
Alcohol	7½ pt.
Water	2½ pt.

CASSIA EXTRACT—57% Alcohol

Cassia Oil	3.3 pt.
Alcohol	7.5 pt.
Water	2.5 pt.

CARAWAY EXTRACT—78% Alcohol

Caraway Oil	1.2 pt.
Alcohol	8.5 pt.
Water	1.5 pt.

CELERY EXTRACT—75% Alcohol

Celery Oil	1½ pt.
Alcohol	12 pt.
Water	4 pt.

CINNAMON EXTRACT—57% Alcohol

Cinnamon Oil	3.3 pt.
Alcohol	7.5 pt.
Water	2.5 pt.

COFFEE EXTRACT

Made by Maceration

Ground Coffee Freshly Roasted	2½ pt.
Alcohol	4½ pt.
Water	5½ pt.
Vanillin	½ gram

Macerate or allow to soak for eight days. Then strain liquid. [Maceration is the process of soaking ingredients in a liquid until it has thoroughly penetrated and the soluble portions are softened and dissolved.]

FOENUGREEK EXTRACT—70% Alcohol

Foenugreek Seeds	8	lb.
Alcohol	22	pt.
Water	10	pt.

Macerate for one month then filter.

LEMON EXTRACT—95% Alcohol

Lemon Oil	6½	oz.
Alcohol	7½	pt.

LIME EXTRACT—95% Alcohol

Lime Oil	6½	oz.
Alcohol	7½	pt.

MACE EXTRACT—83% Alcohol
(Nutmeg Extract)

Mace Oil	8	oz.
Alcohol	7	pt.
Water	½	pt.

MAPLE EXTRACT (Like Mapleine)

Coffee Extract	20	gal.
Foenugreek Extract *	108	oz.
Lovage Oil 1:10	5	oz.
Vanillin	13	oz.
Coumarin	1	oz.
Alcohol	4½	gal.
Hot Water	8	gal.
Caramel	10	gal.

MAPLE EXTRACT

Alcohol	20	oz.
Caramel	20	oz.
Vanillin	2.7	oz.
Lovage Extract	1.3	oz.
Foenugreek Extract	15.5	oz.
Peru Balsam	0.2	oz.
Coffee	16.8	oz.
Hickory Bark	5.5	oz.
Water	20	oz.

MAPLE EXTRACT (For compounding flavors)

Foenugreek Seeds, powdered	1	lb.
Lovage Root, ground	¼	lb.
Alcohol	½	gal.

Let stand a few days. Strain.

Coffee, pulverized	2	lb.
Boiling Water	1	gal.

Boil for 10 minutes. Cool and strain.

Dissolve

Vanillin	2	oz.
Rue Oil	1	dr.
Celery Oil	1	dr.
Glycerin	1	pt.

* Foenugreek Seeds ground	3¼	lb.
Alcohol	7	pt. (extract: 108 oz.)
Water	3	pt. (extract: 54 oz.)

Mix all these ingredients together with 2 pints of heavy syrup or glucose, add enough water to make 2 gallons.

ONION EXTRACT

This extract is made from well-peeled onions which must be finely cut. In order that the extract should not be too mucous in character, the onions are first well expressed, the juice being discarded. To every pound of the residue add 2 pounds of alcohol. Let stand 3 days and then express. Treat the residue once again with 2 pounds of 50% alcohol. Then express after 3 days and unite the liquids. To each pound of extract add ¼ dram true volatile mustard oil.

ORANGE EXTRACT—95% Alcohol

Orange Oil	5	oz.
Alcohol	95	oz.

PEPPERMINT EXTRACT—92% Alcohol

Peppermint Oil	8	oz.
Alcohol	7	pt.

SPEARMINT EXTRACT—82% Alcohol

Spearmint Oil	8	oz.
Alcohol	7	pt.

TONKA EXTRACT—50% Alcohol

Tonka Beans, cut	50	lb.
Alcohol	25	gal.
Water	25	gal.

Macerate for 1 month.

PURE VANILLA EXTRACT—39% Alcohol

Formula No. 1

Mexican Beans, cut } Place in a bag	10	lb.
Bourbon Beans, cut } Place in a bag	50	lb.
Alcohol	30	gal.
Water	30	gal.

PURE VANILLA EXTRACT (By Maceration)—48% Alcohol

Formula No. 2

Vanilla Beans, cut	1	lb.
Alcohol	5	pt.
Water	3	pt.

Let stand for 72 hours.

PURE VANILLA EXTRACT—50% Alcohol

Formula No. 3

Vanilla Beans (Cut very fine)	14	oz.
Cologne Spirit, 190 proof	½	gal.
Distilled Water	½	gal.
Cane Sugar	8	oz.

VANILLA AND TONKA EXTRACT

Vanilla Beans, cut	4	oz.
Tonka Beans, cut	2	oz.
Glycerin	8	oz.
Alcohol	3	pt.
Water	1½	pt.

Macerate 8 days and filter.

PURE VANILLA FLAVOR

Oleo-Resin Vanilla	4	oz.
Alcohol	2	pt.
Water to make	1	gal.

Flavoring ingredients must be completely dissolved in the alcohol before any water is added. Filter clear after 2 or 3 days.

IMITATION VANILLA FLAVOR (Concentrated)

Vanillin	90	oz.
Coumarin	20	oz.
Alcohol	25	pt.
Glycerin	20	pt.
Caramel Color	24	pt.

One pint of above added to two gallons of warm water will make a good imitation vanilla flavor.

IMITATION VANILLA FLAVOR (Non-Alcoholic)

Formula No. 1

Vanillin	1 oz.
Coumarin	⅛ oz.
Glycerin	10 oz.
Water	8 pt.
Caramel Color	To Suit—Add last

IMITATION VANILLA FLAVOR (Non-Alcoholic)

Formula No. 2

Vanillin	1½ oz.
Coumarin	½ oz.
Glycerin	42 oz.
Water	5 pt.
Caramel Color	To Suit

IMITATION VANILLA FLAVOR (Non-Alcoholic)

Formula No. 3

Ethyl Vanillin	1 oz.
Coumarin	¼ oz.
Glycerin	72 oz.
Water	3 pt.
Caramel Color	To Suit

To insure solution of vanillin in above formulas, heat glycerin to temperature not exceeding 140° F. then add vanillin and coumarin, stir. The water must not be too cold when added, or it may precipitate out some crystals of vanillin.

ESSENCES

ABSINTHE

Wormwood Oil	30 oz.
Anise Oil	40 oz.
Fennel Oil	12 oz.
Neroli Oil	1 oz.
Alcohol (70%)	1660 oz.

BOONEKAMP, MAY BITTERS, WORMWOOD BITTERS

Calamus Oil	1 oz.
Orange Oil	1 oz.
Wormwood Oil	1 dr.
Anise Oil	1 dr.
Cloves	2 dr.
Cinnamon Oil	2 dr.
Macerate with pumice	
Alcohol	22 oz.
Water	22 oz.

BRANDY

Prune Oil	2 oz.
Butyric Ether	1 dr.
Cognac Oil	4 dr.
Wine Ether	1 dr.
Alcohol	4 oz.
Or	
Grape Oil	5 oz.
Acetic Ether	4 oz.
Tincture of Allspice	1 oz.
Tincture of Gall	3 oz.
Alcohol	100 oz.

BENEDICTINE

Sweet Orange Oil	100 oz.
Lemon Oil	85 oz.
Angelica Oil	9 oz.
Mace Oil	4 oz.
Bitter Almond Oil	4 oz.
Celery Oil	2 oz.
Cinnamon Oil	4 oz.
Rose Oil	2 oz.
Neroli Oil	1 oz.
Alcohol	4009 oz.

CARAWAY

Caraway Oil	4 oz.
Anise Oil	¼ oz.
Glycerin	4 oz.
Alcohol	5 pt. 6 oz.
Water for	1 gal.

CARAWAY CORDIAL

Lemon Oil	¼ oz.
Bitter Orange Oil	¼ oz.
Fennel Oil	¾ oz.
Carvol	14¾ oz.
Alcohol	2 gal.

DOUBLE CARAWAY CORDIAL

Lemon Oil	½ oz.
Fennel Oil	1 oz.
Star Anise Oil	3½ oz.
Carvol	11 oz.
Alcohol	2 gal.

CITRAL

Citral	2 dr.
Dilute Alcohol	1 pt.

COGNAC

Formula No. 1

Amyl Alcohol	10 oz.
Oenanthic Ether	10 oz.
Alcohol	100 oz.

Or

Pelargonic Ether	1 oz.
Alcohol	20 oz.

Or

Cognac Oil	1 oz.
Ethyl Acetate	10 oz.
Raisin Extract	10 oz.
Alcohol	100 oz.

Or

Cognac Oil	15 oz.
Ethyl Nitrate	30 oz.
Thyme Oil	10 oz.
Ethyl Acetate	30 oz.
Vanillin	3 oz.
Alcohol	1760 oz.

OIL COGNAC

Formula No. 2

Tincture of Prunes	480 g.
Ethyl Butyrate	21 g.
Oil Cognac	28 g.
Oenanthic Ether	42 g.

OIL OF GREEN COGNAC

Formula No. 3

Sebacic Ether	5 g.
Pelargonic Ether	2 g.
Cognac Oil	3 g.
Oenanthic Ether	90 g.

COGNAC

Formula No. 4

Cognac Ether	650 g.
Rum Ether	650 g.
Sweetened "Saltpeter Spirit"	165 g.
Ethyl Acetate	165 g.
Oenanthic Ether	5 g.
Sugar Color	335 g.
Alcohol (90%)	4000 g.

CHARTREUSE

Melissa Oil	6 oz.
Angelica Oil	30 oz.
Clove Oil	6 oz.
Peppermint Oil	40 oz.
Hyssop Oil	6 oz.
Nutmeg Oil	6 oz.
Cinnamon Oil	6 oz.
Alcohol	2000 oz.

Or

Lemon Oil	50 oz.
Sweet Orange Oil	40 oz.
Neroli Oil	10 oz.
Angelica Oil	15 oz.
Fir Oil	8 oz.
Cinnamon Oil	10 oz.
Wormwood Oil	5 oz.
Mace Oil	3 oz.
Coriander Oil	5 oz.
Ethyl Butyrate	5 oz.
Rose Oil	1 oz.
Violet Oil	1 oz.
Alcohol	3060 oz.

FRUIT

Lemon Oil	20 oz.
Orange Oil	30 oz.
Vanillin	2 oz.
Strawberry Essence	10 oz.
Neroli Oil	1 oz.
Benzaldehyde	10 oz.
Alcohol	1000 oz.

GINGER ALE

Ginger Essence	1 pt.
Lemon Essence	1 oz.
Ginger Oil	1 oz.
Vanilla Extract	1 oz.
Rose Essence	½ oz.
Tincture of Cinnamon	1 dr.
Pineapple Essence	½ dr.
Capsicum Essence	2 dr.

CURACAO (Bitter Orange Peel)

Sweet Orange Oil	4 dr.
Lemon Oil	2 dr.
Rose Oil	4 min.
Alcohol	8 oz.
Water	8 oz.

Add 2 oz. Bitter Orange Peel Extract to improve.

CURACAO OIL

Benzaldehyde	15 g.
Oil Cassia	30 g.
Geraniol Extra	30 g.
Linalyl Acetate	50 g.
Petitgrain Oil	75 g.
Orange Oil	650 g.
Lemon Oil	150 g.

GIN

Juniper Oil	1 oz.
Nutmeg Oil	1 dr.
Caraway Oil	6 min.
Fusel Oil	10 min.
Alcohol	16 oz.

Or

Juniper Oil	8 oz.
Glycerin	8 oz.
Orange Oil	¼ oz.
Caraway Oil	¼ oz.
Alcohol	112 oz.

Or

Juniper Oil	10 oz.
Coriander Oil	1 oz.
Caraway Oil	1 oz.
Bitter Almond Oil	1 oz.
Alcohol	115 oz.

CORDIAL GIN

Juniper Oil	5 oz.
Bitter Almond Oil	2 drops
Alcohol	1 gal.

HOLLAND GIN

Formula No. 1

Juniper Oil	5 oz.
Caraway Oil	2 drops
Acetic Ether	5 drops
Alcohol	1 gal.

"HOLLAND" GIN OIL

Formula No. 2

Lemon Oil	3 g.
Anise Oil	3 g.
Angelica Root Oil	16 g.
Fusel Oil Rectified	12 g.
Rosemary Oil	16 g.
Coriander Oil	13 g.
Juniper Berry Oil	940 g.

"OLD TOM" GIN OIL

Formula No. 3

Coriander Oil	270 g.
Anise Oil Rectified	80 g.
Juniper Berry Oil Rectified	610 g.
Caraway Oil	20 g.
Angelica Root Oil	15 g.

PORT

Acetic Ether	1 oz.
Grape Essence	4 oz.
Vanilla Essence	4 oz.
Tincture of Kino	4 oz.
Raspberry Essence	8 oz.

ROSE

Rose Oil (Rose Geranium Oil)	2 dr.
Alcohol	1 pt.

ROSOGLIO

Bitter Almond Oil	40 oz.
Anise Oil	25 oz.
Rose Oil	5 oz.
Cinnamon, Ceylon Oil	2 oz.
Neroli Oil	0.5 oz.
Ambra Tincture	4 oz.
Alcohol (80%)	1520 oz.

RUM

Butyric Ether	1 oz.
Nitrous Ether Spirit	1 oz.
Alcohol	4 oz.

RUM

Rum Ether	200 g.
Ethyl Acetate	40 g.
Cinnamon, Tincture	10 g.
Catechu, Tincture	10 g.
Vanillin, Tincture	10 g.
Ethyl Formate	75 g.
Angelica Root, Tincture	2 g.
Peruvian Bark, Tincture	15 g.
Orange Flower Water	100 g.
Woodruff Essence	30 g.
Butyric Ether	20 g.
Alcohol (90%)	650 g.
Rum	1000 g.

SCOTCH WHISKEY

Dissolve in ½ ounce Alcohol, Creosote	2	drops
Acetic Acid	20	drops
Alcohol	4½	pt.
Water	3½	pt.

Or

Glycerin	1	oz.
Caramel	30	drops
Butyric Ether	10	drops
Oenanthic Ether	10	drops
Formic Ether	10	drops
Creosote	2	drops
Alcohol (80%)	1	gal.

"SCOTCH" WHISKEY OIL

Fusel Oil Rectified	510 g.
Cade Oil	84 g.
Ethyl Butyrate	445 g.
Bitter Almond Oil	20 g.
Sweet Almond Oil	20 g.
Guaiacum Oil	10 g.

SHERRY

Nitrous Ether Spirits	15 oz.
Oenanthic Ether	1 oz.
Orange Tincture	1 oz.

SLIVOWITZ

Cognac Oil	1½ oz.
Fusel Oil	2½ oz.
Benzaldehyde	12 oz.
Alcohol	2½ gal.

SPICE

Cinnamon Oil	20 oz.
Clove Oil	30 oz.
Bitter Almond Oil or Benzaldehyde	60 oz.
Lemon Oil	60 oz.
Sweet Orange Oil	60 oz.
Alcohol	4000 oz.

RUM PUNCH

Rum Essence	3½ oz.
Jamaica Rum	1½ oz.
Lemon Essence	1 oz.
Vanilla Essence	½ oz.

Citric Acid Solution	1½ oz.
Caramel Color (1 : 1)	8 oz.
Alcohol	160 oz.

To make a punch add 2 ounces of the above essence to 1 gallon cherry syrup. Dilute 1 quart of this syrup with 2 quarts of water and 1 quart of alcohol.

RYE

Caramel Color	¼ oz.
Glycerin	¾ oz.
Wintergreen Oil	7 drops
Butyric Ether	10 drops
Formic Ether	10 drops
Vanilla Essence	20 drops
Alcohol (60%)	1 gal.

Or

Amyl Alcohol	10 oz.
Cognac Oil	1 oz.
Ethyl Acetate	6 oz.
Anise Oil	1 oz.
Fennel Oil	0.5 oz.
Coriander Oil	1.5 oz.
Alcohol	400 oz.

TOKAY

Civet Tincture	2½ dr.
Pineapple Essence	8 oz.
Raspberry Essence	8 oz.
Carob Tincture	16 oz.
Grape Essence	8 lb.

WALNUT

Coumarin	8 oz.
Rose Oil	40 min.
Lovage Oil	½ oz.
Alcohol	5 pt. 4 oz.
Water for	1 gal.
Caramel Color	To suit

WHISKEY

Ethyl Acetate	250 oz.
Ethyl Nitrate	200 oz.
Caraway Oil	1 oz.
Anise Oil	1 oz.
Juniper Oil	2 oz.
Alcohol	1000 oz.

ROCK AND RYE WHISKEY ESSENCE

Grain Fusel Oil Rectified	340	g.
Green Wine Lees Oil	12	g.
Peru Balsam	12	g.
Jamaica Rum Essence	12	g.
Vanillin	6	g.
Ethyl Acetate	12	g.
Coumarin	15	g.
Raisin Wine Essence	580	g.
Peach Essence	8	g.
Bitter Orange Extract	50	g.
Cinnamon Oil	2.5	g.
Clove Oil	2.5	g.

WALDMEISTER

Coumarin Tincture	150	oz.
Strawberry Essence	30	oz.
Currant Essence	20	oz.

VERMOUTH

Wormwood Oil	25	oz.
Ginger Oil	10	oz.
Coriander Oil	2	oz.
Calamus Oil	2	oz.
Bitter Almond Oil	0.5	oz.
Alcohol (90%)	800	oz.

AROMATIC WATERS

CHERRY LAUREL WATER

True Fruit Extract of Wild Cherry	8	oz.
Bitter Almond Oil	1	dr.
Balance Water for	1	gal.
Filter through Magnesia	1	oz.

ORANGE FLOWER WATER

Orange Flower Essence	8	oz.
Balance Water for	1	gal.
Filter through Magnesia	1	oz.

ROSE WATER

Rose Essence	4	oz.
Balance Water (lukewarm) for	1	gal.
Filter through Magnesia	1	oz.

PEPPERMINT WATER

Peppermint Oil	2	dr.
Balance Water for	1	gal.
Filter through Magnesia	½	oz.

ESSENCES FOR THE ABOVE AROMATIC WATERS

ORANGE FLOWER ESSENCE

Neroli Oil	2 dr.
Alcohol	1 pt.

ROSE ESSENCE

Rose Oil *	2 dr.
Alcohol	1 pt.

* Rose Geranium oil may be used, being cheaper than the natural Rose oil.

TINCTURES

TINCTURE OF BENZOIN

Gum Benzoin, powdered	6 oz.
Alcohol	2 pt.

Macerate for 7 days in a closed vessel. Filter and add enough alcohol to make the tincture measure 2 pints.

Use: Add a few drops of this tincture to an orange extract to make it cloudy.

TINCTURE OF CAPSICUM

Oleo-Resin Capsicum	1 oz.
Alcohol	1 pt.

Let stand and filter.

TINCTURE OF CELERY

Macerate 1 pound of the sliced and cut plant or of the bruised seeds with 5 pints of diluted alcohol. The seeds must be bruised in a mortar. Percolate, if desired, otherwise filter.

TINCTURE OF COFFEE

Powdered coffee	1 lb.
Diluted Alcohol	3–5 pt.

Macerate for several days; filter.

TINCTURE OF CURACAO

Powdered or sliced peel of Curacao	4 oz.
Diluted Alcohol	20 oz.

Macerate 24 hours in a stoppered bottle. Percolate until 1 pint is obtained.

TINCTURE OF MUSK

Artificial Musk in powder	2 oz.
Alcohol	1 gal.

TINCTURE OF KINO

Kino, 100 grams to make 1000 cubic centimeters. Place the Kino in a capacious flask and pour on it 500 cubic centimeters of boiling water. Agitate the mixture thoroughly and heat it for 1 hour on a water bath, shaking it frequently. Allow the liquid to cool, add enough recently boiled water to make the product measure 500 cubic centimeters and add 500 cubic centimeters of alcohol. Stopper the flask, set it aside in a cool place for 24 hours and then decant the mixture through cheese-cloth. Preserve in a cool, dark place in bottles, tightly stoppered.

TINCTURE OF KINO

Kino in coarse powder	1 oz.
Alcohol (60%)	5 oz.

Macerate and filter.

TINCTURE OF ORRIS ROOT

Orris Root, powdered	15 lb.
Alcohol	3 gal. 1 pt.
Water	1 gal. 7 pt.

Macerate and filter.

TINCTURE OF PERU BALSAM

Macerate 1 ounce of the balsam with 10 ounces of diluted alcohol. The latter will only dissolve a small proportion. However, the undissolved portion is reserved for the next tincture. Filter.

TINCTURE OF RHATANY

Krameria Root in No. 40 powder	1 oz.
Alcohol (60%)	5 oz.

Macerate and filter, or percolate.

TINCTURE OF TOLU

Tolu	1¾ oz.
Alcohol (60%)	16 oz.

Agitate occasionally until dissolved. Filter.

TINCTURE OF STYRAX

Liquid Styrax	1 oz.
Alcohol	½ pt.

Digest by agitation for a week and then decant the clearer portion.

TRUE FRUIT AND FLAVOR SYRUPS

In each gallon of fruit juice, dissolve 15 pounds of sugar and clarify with isinglass solution or by settling.

To each gallon add 1 ounce of powdered citric acid and sufficient color to produce the desired shade. One-tenth of 1 per cent of sodium benzoate may also be added.

ORANGE SYRUP

Cut the oranges in half, express and strain the juice. Mix with an equal bulk of water to each gallon, add 8 ounces of citric acid and 15 pounds of sugar. Do not heat.

If the syrup is intended for immediate consumption it may be flavored with 1 ounce of soluble orange extract, or by paring off the outside yellow rind and rubbing it in a mortar with a portion of the sugar.

Color slightly yellow with certified food orange color.

RASPBERRY, STRAWBERRY (and similar fruit) SYRUPS

Crush the raspberries and set in a warm place until fermentation commences, then express juice and make in the regular way, as in orange syrup.

LEMON SYRUP

Same as orange syrup.

VANILLA SYRUP

Make simple syrup: 15 pounds of sugar to 1 gallon of water, by heat, and clarify. When cold add to each gallon 2 ounces of pure vanilla extract, and tint slightly with caramel.

SIMPLE SYRUP

Take 8½ gallons of warm water, put in a stone jar, add 100 pounds of sugar, stir up and let stand overnight.

ORANGE

ORANGE-ADE SYRUP

Syrup	1 gal.
Orange Emulsion	1 oz.
Benzoate of Soda Solution	1 fluid oz.
Fruit Acid Solution	2 fluid oz.
Color	1 fluid oz.

ORANGE SYRUP

Syrup	1 gal.
Orange Extract	4 fluid oz.
Benzoate of Soda Solution	1 fluid oz.
Fruit Acid Solution	6 fluid oz.
Color	½ fluid oz.

LEMON SYRUP

Syrup	1 gal.
Lemon Extract	4 fluid oz.
Benzoate of Soda Solution	1 oz.
Fruit Acid	6 oz.
Color	1 oz.

LIME SYRUP

Syrup	1 gal.
Lime Extract	4 fluid oz.
Benzoate of Soda Solution	1 fluid oz.
Fruit Acid	6 fluid oz.
Green Color	1 oz.

STRAWBERRY SYRUP

Syrup	1 gal.
Strawberry Extract True Fruit	4 fluid oz.

ANISE SYRUP

Syrup	1 gal.
Oil of Anise	8 drops
Color	Delicate Red

BANANA SYRUP

Syrup	1 gal.
Banana Extract	2 oz.
Citric Acid	½ oz.
Color	Light Yellow

BLACKBERRY SYRUP

Syrup	3 qt.
Blackberry Juice	1 qt.
Citric Acid	1 oz.

COFFEE SYRUP

Syrup	1 gal.
Coffee Fine Powder	2 oz.
Vanilla Extract	1 oz.
Caramel Color	Enough

Bring the syrup to a boil, add the coffee and boil for 5 minutes; then add vanilla and color.

Benzoate of Soda Solution	1 fluid oz.
Fruit Acid	2 fluid oz.
Strawberry Color	3 fluid oz.

RASPBERRY SYRUP

as Strawberry Syrup

CHERRY SYRUP

Syrup	1 gal.
True Fruit Cherry Extract	4 fluid oz.
Synthetic CHERRY F. Oils	1½ fluid oz.
Benzoate of Soda Solution	1 fluid oz.
Fruit Acid Solution	3 fluid oz.
Cherry Color Solution	2 fluid oz.

GINGER ALE SYRUP

Syrup	1 gal.
Ginger Extract	4 fluid oz.
Saturated Water Solution of Tartaric Acid *	1 fluid oz.
Capsicum Tincture	10 min.
Caramel Color	2 fluid dr.

* See under Sundries.

PINEAPPLE SYRUP

Syrup	1 gal.
True Fruit Extract	4 fluid oz.
Benzoate of Soda Solution	1 fluid oz.
Fruit Acid Solution	3 fluid oz.
Color Solution	2 fluid oz.

CARAMELLA SYRUP

Syrup	1 gal.
Caramel Flavor	4 fluid oz.
Benzoate of Soda Solution	1 fluid oz.
Caramel Color	1 pint

IMITATION MAPLE SYRUP, also called BREAKFAST SYRUP

Syrup	1 gal.
Mapleine	2 fluid oz.

VANIILA SYRUP

Syrup	1 gal.
Pure Vanilla Extract	2 fluid oz.
Benzoate of Soda Solution	1 fluid oz.
Fruit Acid Solution	1 fluid oz.
Caramel Color	1 fluid oz.

IMITATION

Syrup	1 gal.
Vanilla Flavor Compound No. 1	10 fluid oz.
Fruit Acid Solution	1 fluid oz.
Caramel Color	1 fluid oz.

ROOTBEER SYRUP

Syrup	1 gal.
Rootbeer Extract	4 fluid oz.
Benzoate of Soda Solution	1 fluid oz.
Caramel Sugar	12 fluid oz.

CHOCOLATE SYRUP

Formula No. 1

Cocoa powder	2½	lb.
Granulated Sugar	35	lb.
Water	2½	gal.
Condensed Milk	5	lb.
Bring to a boil. When cool add		
Extract Vanilla	5	fluid oz.

Formula No. 2

Bitter Chocolate	2	lb.
Sugar Syrup (30° Bé.)	6	lb.

Melt the chocolate, then add the sugar syrup, and boil down to desired thickness. Add one-tenth of 1 per cent sodium benzoate, if desired.

Formula No. 3

Syrup	4	qt.
Cocoa Powder	8	oz.
Vanilla Extract	½	oz.

Bring 1 quart of syrup to a boil, and then add 8 ounces of cocoa, stir for 10 minutes over a slow fire. Remove from fire and add 3 quarts of syrup and vanilla extract.

COCOA PASTE

Cocoa paste is a very thick product, and is a base for ice-cream topping, fudge, or cocoa syrup.

Sugar Syrup (34° Bé.)	1	gal.
Cocoa Powder	3	lb.
Sodium Benzoate	4	g.

The sugar and cocoa powder are warmed up together, rubbing the powder into a smooth paste. Heat as high as 190° F., and then add the sodium benzoate, dissolved in a small amount of water. Be sure there

are no lumps. Chocolate syrup is made by adding 5 gallons of 34° Bé. sugar syrup to 1 gallon of the above formula.

COMPOUND SUGAR—MAPLE SYRUP

Sugar Syrup	85 pt.
Vermont Maple Syrup	15 pt.

CORN SYRUP—CANE SUGAR BLEND

Corn Syrup (39° Bé.)	50 pt.
Sugar Syrup	50 pt.
Caramel Color to suit.	

CANE SUGAR—INVERT SYRUP BLEND

Invert Syrup (37° Bé.)	50 pt.
Sugar Syrup	50 pt.
Caramel Color to suit.	

PINEAPPLE FOUNTAIN SYRUP

Pineapple Juice	⅓ gal.
Simple Sugar Syrup	⅔ gal.
Sodium Benzoate (dissolve in juice)	3 g.

CRUSHED ORANGE FRUIT SYRUP

Orange Pulp	50 lb.
Cane Sugar	50 lb.
Sodium Benzoate	1½ oz.
No. 100 Powdered Pectin	2 oz.
Citric Acid	4 oz.
Water	1 gal.

Prepare the above recipe in the same manner as for crushed pineapple fruit.

ORANGE OR LEMON FRUIT SYRUP

Lemon, Orange or other fruit pulp	1 qt.
Sugar	6½ lb.
Water	5 pints
Citric Acid	½–1 oz.
Pectin	1 oz.

Directions: Mix thoroughly 1 pound of sugar with 1 ounce of pectin. Bring the 5 pints of water to a boil and add slowly while stirring the mixture of pectin and sugar. Then boil vigorously for 1 minute. If artificial color is desired, it may be added at this point. Now add the balance (5½ pounds) of sugar and cook until completely dissolved. Allow to cool to 180° F. and add the citric acid, previously dissolved in a little water. The fruit pulp is then added and slow stirring is continued until cool. If some additional flavor is desired it is added at this point. If a

preservative is indicated then 3.6 grams of benzoate of soda is stirred in. The finished syrup is stirred slowly while bottling. It is advisable to shake each bottle the next day before packing for shipment. The pulp will now remain in suspension for long periods.

CHERRY FOUNTAIN SYRUP

Cane Sugar	7 lb.
Water	5 pt.
True Fruit Cherry and Wild Cherry Extract	4 oz.
Citric Acid	¾ oz.
Amaranth Food Color	Enough to color

This formula will make 1 gallon of syrup.

INVERT SUGAR SYRUP

Granulated Sugar	100 lb.
Water	44 lb.
Tartaric Acid	50 g.

Mix these ingredients together and boil for 30–35 minutes. Stop boiling when temperature reaches 230° F. This syrup has a sweetening value at least 20% greater than a similar cane sugar syrup.

CRUSHED STRAWBERRY FRUIT MADE WITH COLD PACK FRUIT

Fruit and Juice	45 lb.
Cane Sugar	55 lb.
Citric Acid	2 oz.
Sodium Benzoate	1.2 oz.
Agar-Agar	9 oz.

1. Soak agar-agar overnight in 1 gallon of water. Then cook up with 5 pounds of sugar to 220° F. Add to 2 on cooling table and mix in with paddle.

2. Cook juice and 50 pounds of sugar to 220° F. Then add the fruit and cook to 223° F. Dissolve sodium benzoate in 2 ounces of warm water and add to kettle with stirring. Then transfer to the cooling table.

PREPARATION OF RED STRAWBERRY COLOR

Amaranth—Certified Food Color	2 oz.
Ponceau 3R—Certified Food Color	1 oz.
Sodium Benzoate	3 g.
Citric Acid	½ oz.
Enough water to make	1 gal.

Dissolve the acid and sodium benzoate separately in a small amount of water, and add separately to the gallon.

STRAWBERRY FOUNTAIN SYRUP

Strawberry Juice—Drained from cold pack	1/3 gal.
Simple Sugar Syrup	2/3 gal.
Strawberry Color	1/2 oz.
Sodium Benzoate (dissolve in juice)	5 g.
Citric Acid (dissolve in juice)	3/4 oz.

Add the sodium benzoate and citric acid solutions separately to the gallon.

CRUSHED PINEAPPLE FRUIT

Crushed Pineapple (No. 10 Tins)	30 lb.
Cane Sugar	15 lb.
Sodium Benzoate	18 g.
No. 100 Powdered Pectin	3 oz.
Water	1 gal.

Mix the powdered pectin with 5 pounds of sugar. Add this to the boiling water, while stirring, then add balance of the sugar and cook to 220° F. Now add crushed pineapple and cook to 225° F. Shut off steam and add the sodium benzoate previously dissolved in 5 ounces of water. Stir around and then transfer immediately to the cooling table.

NUT SUNDAE

Chopped Walnut, Pecans, or Almonds
Sugar Syrup (34° Bé.)
Maple or Walnut Flavor

Cover the nuts with a hot 34° Bé. sugar syrup and let soak overnight. In the morning fill the 1/2-gallon jars with the nuts, cover with a 34° Bé. syrup, add maple or walnut flavor, and then sterilize 30 minutes at 180° F. Sodium benzoate, one-tenth of 1%, and caramel color may be added, if desired.

LEMONADE POWDER FOR SOFT DRINKS

Cane Sugar	86 oz.
Dry Bordens' Lemon Powder	14 oz.
Citric Acid	1/10 oz.

Color with a yellow certified food color.

The above powders are mixed and colored. Four ounces of above powder when mixed with a pint of cold water will make delicious lemonade.

EMULSIONS

LEMON EMULSION

Gum Tragacanth	18 oz.
Water	4 gal.

Place the gum tragacanth in a kettle similar to a baker's mixing machine. Pour the water over it, stir well with an egg whip until all the lumps have disappeared. Let stand overnight.

Next morning squeeze the gum solution through a cheesecloth bag. Sugar bag may also be used.

Add to the homogeneous gum solution

Glycerin	1 qt.

Place the kettle under the machine and allow to mix for 5 minutes at slow speed.

Now put the machine in second speed and gradually add

Lemon Oil	4 qt.

After 1 quart of the oil has been added, it is advisable to put the machine in third speed, as otherwise the oil will not be taken up by the gum solution. When all the oil has been added stop the machine, scrape the walls of the kettle with a long-bladed spatula and add 5 ounces of benzoate of soda in solution, to prevent fermentation. Start the machine again in third speed for about 5–10 minutes.

The emulsion is then ready to be filled in bottles.

Yield—about 43 1-pound bottles.

LEMON OIL EMULSION

1. Gum Arabic	13 oz.
2. Terpeneless Oil of Lemon	20 oz.
3. Lemon Oil	20 oz.
4. Glycerin	40 oz.
5. Water	to make 10 gal.

Mix 1 and 4, then mix in 2 and 3 to this; add 5 slowly with good stirring. Beat intermittently until homogeneous. Then pass through an homogenizer.

ORANGE OIL EMULSION

Gelatin	4 oz.
Water	16 lb.
Cane Sugar	24 lb.
Invert Sugar	60 lb.
Terpeneless oil orange	20 oz.
Oil Orange	20 oz.

Dissolve the gelatin in the water, add the cane sugar and heat until dissolved. Then add the invert sugar and mix well; homogenize.

ORANGE EMULSION

As Lemon

The other flavored emulsions are generally prepared in smaller quantity. This prevents storing too long and a fresh product is always on hand.

FORMULA FOR SMALLER BATCHES

(About 16 1-pound bottles)

Gum Tragacanth	9 oz.
Water	2 gal.
Glycerin	3 pt.
Oil	1 pt.

Proceed as under Lemon Emulsion.

RYE BREAD EMULSION

Caraway Oil

Proceed as under Lemon Emulsion.

CINNAMON EMULSION

Cassia Oil

Proceed as under Lemon Emulsion.

STRAWBERRY EMULSION

Synthetic Strawberry Oil

Proceed as under Lemon Emulsion, etc.

FORMULA FOR 1-POUND BOTTLES

ALMOND EMULSION

Gum Tragacanth	5 oz. 5 dr.
Water	5 qt.
Glycerin	10 oz.
Bitter Almond Oil	10 oz.

Proceed as under Lemon Emulsion.

VANILLA EMULSION

Vanillin	3 oz.
Coumarin	½ oz.

Dissolve these in 3 pints of glycerin. Then emulsify with 1 pint of SESAME OIL.

DELACATOR EMULSION

Vanillin	¼ oz.
Coumarin	1/16 oz.
Lemon Oil	1 oz.
Orange Oil	2 oz.
Almond Oil	1 oz.
Rose Oil	¼ oz.
Strawberry Oil	¼ oz.
Anise Oil	1/16 oz.

Dissolve these in 3 pints of glycerin. Then emulsify with 1 pint of SESAME OIL.

ROOT BEER EMULSION

Gum Arabic	17 lb.
Water	6½ gal.

Heat and stir until dissolved. Filter through cheese cloth.

Formula No. 1

(To make 10 gallons of concentrate)

Wintergreen (Synthetic) Oil	1 pt.
Sassafras Oil	1 pt.
Vanillin	4 oz.
Coumarin	1 oz.

Formula No. 2

(To make 10 gallons of concentrate)

Wintergreen (Synthetic) Oil	2 qt.
Sassafras Oil	1 qt.
Clove Oil	1 pt.
Cassia Oil	1 pt.

Emulsification or absorption of the oils in the gum solution can be accomplished by simply gradually pouring the oils into the gum solution, while the same is being vigorously agitated. It should be agitated for at least 10 minutes, and as this process is going on you will note the tendency of the gum solution to thicken. If you have an emulsifier, so much the better; an emulsifier, however, is not essential, as a good stirring with a wooden paddle or a large size cream whipper will do the work. While you are mixing this solution, about 1 gallon of sugar coloring (caramel coloring) should be added to give the concentrate a dark color. The resulting product is then made up with water to make exactly 10 gallons and then given another thorough stirring before being placed in a container. One gallon of this product will flavor 20 barrels of root beer.

OIL OF BITTER ALMOND EMULSION

Gum Arabic	10 oz.
Bitter Almond Oil	2 oz.
Cane Sugar	8 oz.
Water	120 oz.

Mix together the sugar and gum. Then add it to the water, which is agitated by means of a rapid mixer, then allow to mix until a uniform emulsion results. Then add the oil slowly until completely emulsified.

CRUSHED FRUITS FOR THE FOUNTAIN

Peel, pit, and prepare the fruit.

Pass through a meat chopper having a perforated plate with medium-sized holes.

To each gallon of this add

Sugar	8 lb.
Tartaric Acid	1 oz.

Place in kettle, heat to 190° F., and stir until sugar is dissolved.

To each 3 gallons of this add

Japanese Gelatin (Agar-Agar)	2 oz.

which has been soaked in cold water for 6 hours, and dissolved by heat in a little water.

Stir well together, add color to produce desired shade.

To each 100 pounds of this product add

Preservative (Benzoate of Soda Solution)	2 oz.

TRUE FRUIT EXTRACTS

Manufacturing Process

True fruit extracts made by pressing the fruit, peelings, and kernels, and then distilled with diluted alcohol, will result in an extract of richer aroma and flavor than if made from the fresh fruit alone. Add to the pressings 2 to 3 times its weight, 60 to 70% alcohol. Allow to stand overnight and distill over the following morning. Discontinue the distillation when the distillate shows about 40% alcohol. Do not distill below this percentage.

APPLE

Squeeze the apples in a stone mill to pulp and press them afterwards in a fruit press.

Yield: 60–75% juice

To 84 litres of strained apple juice add 16 litres of alcohol or place 10 kilograms of fresh apple peelings in 16 litres of alcohol, allow to stand for 3 days, then press.

To the press residue add 20 litres of apple juice and allow to stand for 2–3 days to recover the alcohol remaining in the residue. The whole makes about 100 litres.

APRICOT

Press apricots which have been previously freed from stones.
Yield: 70% juice
To 84 litres of strained juice add 16 litres of alcohol.

BLACKBERRY

Press only full ripe berries
Yield: 75–90% juice
To improve aroma add 5% sugar and let ferment. Strain.

BILBERRY

Press the berries between layers of willows.
Yield: 70–90% juice
Add sugar 4–5% and let ferment a short time. Add a little alcohol.

CHERRY

Use either sour cherries or a mixture of sweet and sour, but the sour should predominate.

Grind the cherries with the kernels and allow the juice to stand for 12 hours. Push the layer forming on top back into the liquid. Strain and add alcohol.

CURRANT

Press the fruit with the stems.
Yield:

Red berries:	75–80% juice
White berries:	65–75% juice
Black berries:	65–75% juice

The black juice must be fermented.

To the red-berry juice add 10% of the black juice to obtain a more powerful and wine-like aroma.

LEMON

Press the lemons and clarify the juice at first by filtering through FELT. Further clarify by adding 10 grams of dry albumen dissolved in 250 grams for each 10 litres of juice.

Heat juice to 65° C.

Filter through asbestos (Seitz Filter style).

Remove bitter taste by charcoal treatment.

PEACH

Press the fruit

Yield: 65% juice.

Little aroma.

Aroma can be increased by adding other fruit juices.

ORANGE

Use only hard and sour oranges

Press and strain

Add a little alcohol

RASPBERRY

Press the fruit

Yield: 65–90% juice

To the juice add 3% of sugar and let ferment at 18° C.

Duration of fermentation 3–6 days

Push the layer forming on top back into liquid

To test if fermentation is complete, filter a small quantity of the juice and add the same volume of alcohol. After ½ hour standing no cloudiness must appear, otherwise ferment longer.

Add a little alcohol to the strained juice.

STRAWBERRY

Select the fruit carefully, using fresh fruit only. Press between willows.

Yield: 70–85% juice

Add to the residue 18 litres of alcohol, let stand for 1 day, then decant and add to the juice.

RED WHORTLEBERRY

Press between willows.

Yield: 80% juice

Let ferment

The juice is used to increase the aroma of weak fruit juices.

TRUE FRUIT AROMAS (CONCENTRATE)

Extract the fruit with alcohol several times.

Shake out with pure petroleum ether, then separate and distill off the ether. The residue is the natural fruit aroma together with wax. Chill and the wax will separate.

PROCEDURE

Press the fruit. Place in a percolator cask and cover it with alcohol.

After 24 hours allow percolation to proceed, adding alcohol until 25 gallons are obtained from 100 pounds of fruit. This is percolate No. 1.

Continue percolation until a second 25 gallons are obtained. This is percolate No. 2.

Distill the residue with percolate No. 2 and use this for treating another 100 pounds of fruit.

Percolate No. 1 is shaken out with one-tenth its volume of petrol ether. Separate. Recover alcohol. Distill off ether, using column. Dissolve the remaining oil in 5 times its quantity of alcohol. Freeze out the wax. Filter.

Strength: 100 times stronger than ordinary essence.

Use: 1 ounce to 50 gallons of syrup.

Note: Fruit juice may also be treated this way. If fruit residue and juice are worked up, 3 tons of berries yield 2 pounds of oil and 10 pounds alcoholic concentrated fruit aroma. The solvents (alcohol and ether) can be used over again.

MANUFACTURE OF DRY SHREDDED COCONUT

The preparation of dry or dessicated coconut for domestic confectionery and baker's consumption has developed into a very large business. Shiploads of coconuts arrive daily from the West Indies to be manufactured into a highly commercialized product. The coconuts come packed in burlap bags, containing anywhere from 80 to 120 fruits depending on their size. When the coconuts arrive at the factory, the nuts are placed in steam cabinets and subjected to a temperature of 212° F. for half an hour. The object in placing these nuts in the steam cabinet is to loosen up the hard shell from the meat. Working with a small tool similar to an oyster knife, the nuts are opened. The nut meat itself is covered with a tough brown skin which is removed by skilled workers. The nut meats are then thoroughly washed by passing under water sprays and conveyed to the shredding machines. A belt conveyer serves the battery of shredders, carrying the product to a galvanized iron tank truck thus relayed to the sweetening operation nearby.

Rotating copper drums are used for incorporating the sugar. The shredded coconut is tumbled around for 20 to 30 minutes, refined cane sugar is used for sweetening, a small quantity of salt is added, glycerine is incorporated to render the shreds less brittle and when the tumbling is completed the shredded coconut is transferred over the driers. The product enters the driers with about 45% moisture, is warmed and dried by addition of conditioned air and finally cooled. The maintaining of a proper moisture content is very important in order to be assured that there will be no infestation with insects. Following the drying operation the product is screened, separated into four grades, differentiated by the length of the shreds. The product is then piled up in bins for blending and equalizing the moisture content. Dessicated coconut is marketed in barrels, tins, carboard boxes, and because of its high oil content, glassine paper liners should be used.

WALNUTS IN SYRUP FOR USE AT FOUNTAIN

Granulated Sugar	100 lb.
Water	7 gal.
Walnuts (usually ¼ inch)	Pack in jars.

Boil sugar and water to 221° F. then cover walnuts with this hot syrup. Place cover on jar and pasteurize for 30 minutes.

Avoid iron contamination.

COFFEE SYRUP

Drip Coffee	10 pt.
Granulated Sugar	25 lb.
Sodium Benzoate	1 oz.

In the hot drip coffee dissolve the sodium benzoate. Now add the sugar, stir, until solution is completed.

CHOCOLATE SYRUP (Double Strength)

Cocoa Powder Natural	14	lb.
Cocoa Powder Dutched	1	lb.
Granulated Sugar	65	lb.
Water	35	pt.
Vanillin	2½	g.
Oil Bitter Almonds	2	drops
Sodium Benzoate	4	oz.
To make	10	gal.

Mix the cocoa powder with part of the sugar. Bring the water to a boil, now slowly add the cocoa powder, mix and agitate until smooth then add balance of sugar. Heat around 200° F. for 30 minutes, add flavor and benzoate. When cold add enough water to make 10 gallons.

1 gallon of this added to 1 gallon of simple syrup will make 2 gallons of regular chocolate syrup.

BEVERAGES

The essential principles are extracted by

INFUSION with hot spirit (if the aromatic principle is not too volatile), the ingredients being first moistened with boiling water; or by

MACERATION with cold spirits, which may require hours, days, or even months, according to the solubility of the essential principles; by

DIGESTION or prolonged infusion or maceration in hermetically closed vessels, when the aromatic principles are extracted only with difficulty by cold alcohol; or by

DISTILLATION, when only the natural essential oils or other volatile flavoring constituents are required.

The following plants should always be distilled by steam: Absinth, Anise, Balms, Caraway, Citronella, Fennel, Juniper, Hyssop, Lavender, Melilot, Mint, Orange, Rose, Sage, Thyme.

Aromatic tinctures are prepared by filtration or percolation.

PERCOLATION

Moisten the powdered drug or mixed drugs with a sufficient quantity of the menstruum to rend it evenly and distinctly damp. Transfer it to a percolator and, without pressing the powder, allow it to stand well covered for 6 hours. Then pack it firmly (unless otherwise stated) and pour on enough of the menstruum to saturate the powder and leave a menstruum above it. Close when dripping begins, cover the percolator, macerate for 24 hours. Let drip slowly.

CLARIFICATION OR COLLAGE

with fining materials is best avoided if possible but is often necessary. The principal materials and the proportions used are as follows:

Albumen (White of Egg)
  1 egg for every 10 litres
Gelatin
  30 grams per 100 litres
Isinglass
  10 grams per 100 litres
Milk
  1 litre boiled in 100 litres with 15 grams Alum

Animal or Vegetable Carbon
Alum and various "filtering powders" are also employed
For colored liquids filtration is preferable to collage
Tannin and Gelatin Combinations
Bentonite

BITTERS

They are prepared by maceration without distillation and are considered to be tonic and stomachic and to improve the appetite when taken in moderation.

A bitter made according to the following formula, which represents the proportions necessary to make 20 gallons, may be taken as typical:

Gentian	6 lb.
Cinnamon	5 lb.
Caraway	5 lb.
Juniper Berries	1 lb.
Cloves	½ lb.

Macerate in 7 gallons of 60% alcohol for 10–12 days. Strain, filter, add syrup consisting of 10 pounds of sugar to 13 gallons of water and color with cochineal.

ENGLISH BITTERS

Digest

Outer Rind of Dried Orange Peel	5 oz.
Cinchona Bark	6 oz.
Gentian	6 oz.
Carduus Benedictus	8 oz.
Centaury	8 oz.
Wormwood	8 oz.
Orris Root	4 oz.

with 12 gallons of proof spirits and 12 pounds of sugar.

ORANGE BITTERS

Orange Peel, Ground	5 lb.
Coriander Seed, Ground	2 lb.
Lemon Peel, Ground	1 lb.
Saccharin (1 : 300)	¼ oz.
Alcohol	8 gal.
Distilled Water	12 gal.

Macerate 14 days with a portion of the alcohol and water (enough to cover the drugs). Percolate with the remainder. Filter, if necessary.

ANGOSTURA TYPE BITTERS

Gentian Root	4	oz.
Calisaya Bark	10	oz.
Canada Snake Root	10	oz.
Virginia Snake Root	10	oz.
Licorice Root	10	oz.
Yellow Bark	10	oz.
Allspice	10	oz.
Dandelion Root	10	oz.
Angostura Bark	10	oz.
Cardamom Seeds	6	oz.
Tolu Balsam	4	oz.
Galanga	4	oz.
Rhubarb	4	oz.
Orange Peel	1	lb.
Alkanet Root	1	lb.
Caraway Seed	1½	oz.
Cinnamon	1½	oz.
Cloves	½	oz.
Catechu	2	oz.
Coriander Seed	2	oz.
Nutmeg	2	oz.
Wormwood	2	oz.
Mace	1	oz.
Red Sanders Wood	1¼	lb.
Turmeric	8	oz.

Macerate 15 days in 50 gallons of proof spirits. Add 30 pounds of honey and filter.

CORDIALS

	Ordinaire	Demifine	Fine	Superfine
Alcohol	6½ gal.	7¼ gal.	8¼ gal.	9¼ gal.
Sugar	27½ lb.	55 lb.	82½ lb.	110 lb.
Water	17½ gal.	15 gal.	12 gal.	9 gal.

BENEDICTINE

Angelica Root	2 lb.
Angelica Seed	1 lb. 4 oz.
Cloves	6 oz.
Balm Herbs	2 lb.
Cinnamon Bark	5 oz.
Mace	5 oz.
Arnica Flowers	5 oz.

10 lb. of herbs need 4½ gal. of Menstruum
6½ lb. of herbs need 3 gal. of Menstruum

MENSTRUUM

Water	3 gal.
Alcohol	1½ gal.
	4½ gal.

Macerate for 2 weeks. Decant and press. Add

Peppermint Oil	1 oz.
Lemon Oil	2 oz.

Use 1 ounce of the infusion for the gallon of Cordial.

EXAMPLE

To make 5 gallons of SUPERFINE BENEDICTINE according to the scale just given we use

Alcohol	2¼ gal
Sugar	27½ lb.
Water	2¼ gal.
Infusion	5 oz.
Tartaric Acid Solution	Trace
Liquid Egg Color	q.s.*

* q.s. = quantum satis (Latin), enough to suit.

BENEDICTINE TYPE

Bitter Almonds	40 g.
Powdered Nutmeg	4500 g.
Vanilla Extract	120 g.
Powdered Cloves	2 g.
Sliced Lemon	2 g.
True Saffron	6 g.
Sugar	2000 g.
Boiling Milk	1000 cc.
Alcohol (95%)	2000 cc.
Distilled Water	2500 cc.

Mix. Let stand 9 days, agitate occasionally. Filter.

BENEDICTINE TYPE

Cloves	2 g.
Nutmeg	2 g.
Cinnamon	3 g.
Balm	25 g.
Peppermint	25 g.
Angelica	25 g.
Genepi of the Alps	25 g.
Calamus	15 g.
Cardamom	50 g.
Arnica Flowers	8 g.

Macerate 2 days in 4 litres of alcohol, 3 litres of water added. Distill,

take 4 litres. Make syrup using 4 kilograms of sugar, 2 litres of water, bring up the whole to 10 litres with water. Color and filter.

CHARTREUSE

Bitter Orange Peel	1 lb. 4 oz.
Ginger Root	5 oz.
Cinnamon Bark	3 oz.
Zedoary Root	15 oz.
Calamus Root	10 oz.
Iva Herb	10 oz.

2 gal. Menstruum. See under Benedictine.

Macerate 2 weeks. Decant, press and filter. The infusion is improved by the addition of

Coriander Oil	1 oz.
Angelica Oil	1 oz.
Thyme Oil	1 oz.

Make the finished product as directed under "Benedictine." Color "green" or "yellow."

CHARTREUSE (Trappistine)

Originally prepared at one of the Trappist monasteries in Italy.

Large Absinthe	20 g.
Angelica	40 g.
Mint	80 g.
Cardamom	40 g.
Balm	30 g.
Myrrh	20 g.
Calamus	20 g.
Cinnamon	4 g.
Cloves	4 g.
Mace	2 g.
Alcohol	4.5 litres and 3 litres of water added
Sugar	3.75 Kg. and 2 litres of water added

Macerate for 2 days, distill and rectify.

Add syrup and color green or yellow. Bring up with water to 10 litres.

ANISE CORDIAL

Anethol	7 fluid drams
Fennel Seed Oil	80 min.
Bitter Almond Oil	16 drops
Alcohol	8 pt.
Syrup	5 pt.
Water	16 pt.

Mix the oils and anethol with the alcohol, then the syrup with the water, mix the two and filter.

ANISETTE

Anise Seeds	4	oz.
Coriander Seeds	1	oz.
Fennel Seeds	1	oz.
Alcohol	½	gal.
Water	3	qt.

Macerate 5–6 days. Distill over 7 pints. Sweeten with 2½ pounds of sugar. Strength 30% by volume.

BRANDY

(Apricot, Cherry, Ginger, Peach)

By macerating the fresh fruits for prolonged periods or mixing the fresh fruit juice with Brandy and sweetening with sugar. Essential oils are also used.

GENERAL FORMULA

Extract	¾–1	oz.
Tartaric Acid	½	oz.
Syrup	¾	gal.
Alcohol	1	gal. 1 pt.
Water	1	gal. 1 pt.

Strength about 38% by volume.

COCKTAILS

The cocktail is a compounded drink much used in America. The spirit basis is brandy, gin, whiskey, or other spirits and their different varieties, depending upon the kind of flavoring used, are numerous. A bottle of Brandy Cocktail is made as follows: ½ Brandy, ¼ Water, a wineglass of Bitters, Curacao, and Gum syrup. Whiskey and gin cocktails may be made by the same recipe, substituting these spirits for brandy.

MANHATTAN COCKTAIL

Vermouth	½	wineglass
Whiskey	½	wineglass
Syrup	30	drops
Angostura Bitters	10	drops
Curacao	6	drops
Lemon Peel	1	small strip
Little Ice		

MARTINI COCKTAIL

Gin	½ wineglass
Vermouth	½ wineglass
Rock Candy Syrup	6 drops
Orange Bitters	12 drops
Lemon Peel	1 small strip

GIN RICKEY

Gin	1 wineglass
Lemon or Lime Juice	1 dessert spoon
Carbonated Water	Enough to fill glass
Ice	

LIQUEURS

CREME DE MENTHE

Is one of the most popular liqueurs and is typical of the class of Cremes, which are highly sweetened and usually flavored with only one characteristic ingredient, e.g., Creme d'Anis, Cacao, Cafe, Menthe, Noyan, Orange, Vanilla. The inferior grades are made by flavoring plain spirit with essential oil without distillation.

Peppermint	600 g.
Balm	40 g.
Cinnamon	20 g.
Sage	10 g.
Orris Root	10 g.
Ginger	15 g.

These are macerated with 5 litres of alcohol and 3 litres of water distilled and sweetened with 3.75 kilograms of sugar and made up with water to 10 litres. Color green.

GENERAL FORMULA

Extract 1 ounce per gallon (start with less and taste, then add. Strength of extract varies).

Syrup	1 gal. 1 pt.
Water	1 gal. 7 pt.
Alcohol	1 gal. 7 pt.

Color green.

CURACAO

Outside Yellow Rind of Orange	1 lb.
Ground Bitter Orange Peel	½ lb.
Ground Saigon Cinnamon	½ oz.
Ground Nutmeg	¼ oz.
Alcohol	2 gal.

Soak 2 weeks. Filter. Add 7½ pounds of sugar dissolved in ½ gallon of water. Add a trifle of caramel color to tint.

CURACAO LIQUEUR

Tincture of Fresh Orange Peel	1	oz.
Tincture of Tangerine Orange	1	oz.
Orange Oil	2	dr.
Alcohol	12	oz.
Water	10	oz.
Syrup	8	oz.

Mix, macerate for a few days, and filter.

KÜMMEL

GENERAL FORMULA

Caraway Oil	½	oz.
Capsicum Tincture	¾	oz.
Syrup	1	gal.
Water	4	gal.
Tartaric Acid	½	oz.
Alcohol	5	gal.

CHEAP QUALITY

Caraway Oil	4	oz.
Fennel Oil	7½	dr.
Bitter Almond Oil	15	drops
Syrup	40	lb. of Sugar in 12 gal. of Water
Alcohol	7	gal.
Fine with Alum		

SUPERIOR QUALITY

Caraway Seeds	4	lb.
Fennel Seeds	¼	lb.
Florentine Orris Root	2	oz.

Macerate with 10 gallons of alcohol and 8 gallons of water. Distill. The first part of the distillate is set aside because of its rough character, and about 8 gallons are then distilled over for making the fine Kümmel. The last 3 or 4 gallons are used for inferior grades. To the middle fraction a syrup made with 60 pounds of sugar in 10 gallons of water is added and the whole well mixed in an open heated vessel. The liquor is then cooled and made up with water to 20 gallons. It may be fined with isinglass.

KÜMMEL

Caraway Oil	30 drops
Peppermint Oil	3 drops
Lemon Oil	3 drops

Acetic Ether	30 drops
Spirit of Nitrous Ether	30 drops
Sugar	72 oz.
Alcohol	96 oz.
Water	96 oz.

Dissolve the oils and ethers in the alcohol and the sugar in the water. Mix and filter.

MARASCHINO

Alcohol	2 gal.
Bitter Almond Extract	2 dr.
Raspberry Syrup	½ pt.
Orange Flower Water	½ pt.
Sugar	7½ lb.
Water	½ gal.

Mix alcohol and almond extract. Dissolve sugar in water. Add orange flower water and raspberry syrup. Then mix and filter.

PEPPERMINT (Eau des Chasseurs) (SPORTSMAN'S CORDIAL)

Peppermint Water	1 pt.
Gin	1 pt.
Sugar	¾ lb.

RATAFIA

Cherry Juice	20 litres
Alcohol	20 litres
Sugar	13.5 Kg.
Bitter Almond Water	4–8 litres

VERMOUTH

The principal varieties are the French and the Italian, the basis in each case being white wine flavored with various herbs. Inferior kinds are made from brandy or other spirits sweetened and flavored with essential oil.

The French variety is less sweet and stronger in bitter principles, particularly wormwood, than the Italian.

ITALIAN VERMOUTH

White Wine	100 litres
Coriander	500 g.
Rinds of Bitter Oranges	250 g.
Orris Root, Powdered	250 g.
Elder Flowers	200 g.
Red Cinchona	150 g.
Calamus	150 g.
Absinthe (Large)	125 g.

Holy Thistle	125 g.
Elecampane Root	125 g.
Centaury (Little)	125 g.
Germander	125 g.
Chinese Cinnamon	100 g.
Angelica Root	65 g.
Cloves	50 g.
Galanga	50 g.
Nutmeg	50 g.
Cassia	30 g.

Digest for 5 or 6 days, draw off the liquor, size with fish glue and allow to stand for 15 days. Strength 27% by volume.

FRENCH VERMOUTH

Wormwood	4 oz.
Gentian	2 oz.
Angelica Root	2 oz.
Blessed Thistle	4 oz.
Calamus	4 oz.
Elecampane Root	4 oz.
Centaury Leaves	4 oz.
Germander Leaves	4 oz.
Nutmegs	15 oz.
Sliced Oranges	6 oz.
Alcohol	9 pt.
White Wine (Sweet)	20 gal.

Macerate for 15 days and filter.

FRENCH VERMOUTH

Cardamom	½ oz.
Cinnamon	½ oz.
Cloves	½ oz.
Coriander	2 oz.
Fennel	2 oz.
Star Anise	2½ oz
Peppermint	4 oz.
Centaury Herb	4 oz.
Balm Leaves	8 oz.
Angelica Root	8 oz.
Gentian Root	1 lb.
Alpine Wormwood	7 lb.
Percolate with Wine Brandy	6 lb.
Alcohol	7 lb.
Sweet Wine	16 lb.

After 3 days collect as final result and without expressing, 10 pounds of extract.

USE

Extract ½ pound of sugar (according to the sweetness of the wine) 12–15 pounds. Dissolve sugar in 2 gallons of wine; add 1 gallon of alcohol, 6½ gallons of wine.

VERMOUTH—GENERAL FORMULA

Cardamon	½ oz.
Cinnamon	½ oz.
Cloves	½ oz.
Coriander	2 oz.
Fennel	2 oz.
Star Anise	2½ oz.
Peppermint	4 oz.
Centaury Herb	4 oz.
Balm Leaves	8 oz.
Angelica Root	8 oz.
Gentian	16 oz.
Alpine Wormwood	7 lb.

Macerate with 1½ gallons of alcohol and 3 gallons of water for 15 days. Filter off. This is the extract.

USE

A. FRENCH VERMOUTH

Syrup	2½ gal.
Extract	½ gal.
Tartaric Acid	6 oz.
Alcohol	5 gal.
Water for	20 gal.
Little Caramel Color	

Strength 25% by volume.

B. ITALIAN VERMOUTH

Syrup	5 gal.
Extract	1 qt.
Tartaric Acid	5 oz.
Alcohol	5 gal.
Water for	20 gal.
Caramel Color	To suit

Strength 25% by volume.

WHISKEY

RYE

Proof Spirit	50 gal.
Pelargonic Ether*	2 oz.
Pear Oil	1 oz.
Wintergreen Oil (Dissolved in Alcohol)	10 drops
Acetic Ether	4 oz.
Clove Oil (Dissolved in Acetic Ether)	4 drops

* Pelargonic Ether appears to be identical with Oenanthic Ether.

SCOTCH

Alcohol (95%)	46 gal.
Scotch Whiskey	8 gal.
Water	18 gal.
Honey	3 lb. in 1½ gal. of wa
Creosote	5 drops
Acetic Acid	2 oz.
Pelargonic Ether	1 oz.
Ale	1 gal.

IRISH

Spirits	30 gal.
Irish Whiskey	5 gal.
Old Ale	½ gal.
Creosote (Dissolved in Acetic Acid)	4 drops
Pelargonic Ether	1 oz.

BRANDY

Cologne Spirits Proof	40 gal.
Cognac Oil **	⅙ oz.
Burnt Sugar Coloring	1½ pt.
Tannin	¼ oz.
Brandy Essence *	1 oz.
Alcohol	1000 oz.
Water	600 oz.

RUM

Rectified Spirits	6 qt.
Jamaica Rum	22 qt.
Rum Essence ***	1½ oz.
Vanilla Essence	1/10 oz.
Water	2 qt.
St. John's Bread	1½ oz.
Raisins	1½ oz.

* Brandy Essence	Grape Oil	5 oz.
	Acetic Ether	4 oz.
	Allspice Tincture	1 oz.
	Gall Tincture	3 oz.
	Alcohol	100 oz.
** Cognac Oil	Amyl Alcohol	5 oz.
	Oenanthic Ether	5 oz.
*** Rum Essence	Butyric Ether	15 oz.
	Acetic Ether	2 oz.
	Vanilla Tincture	2 oz.
	Violet Essence	2 oz.
	Alcohol	90 oz.

Or

Proof Spirits	40	gal.
Rum Essence	½	pt.
Sugar Coloring	½	pt.
Sugar Syrup	1	qt.

GIN

Corn Spirits	80	gal.
Turpentine Oil	1	pt.
Juniper Oil	8	oz.
Salt	21	lb.
Water	35	gal.
Caraway Oil	½	oz.
Sweet Fennel Oil	¼	oz.
Cardamoms	8	oz.

Distill over 100 gallons.

SYRUP TABLE

Giving the approximate amount of Sugar in 1 gallon of syrup at 60° F.

Per Cent by Weight (Brix)	Degrees Baumé	Sugar, Pounds	Per Cent by Weight (Brix)	Degrees Baumé	Sugar, Pounds
27	15	2½	51.5	28	5¼
29	16	2⅝	53.5	29	5½
31	17	2⅞	55	30	5⅝
33	18	3	57	31	6
35	19	3¼	59	32	6¼
36	20	3½	61	33	6½
38	21	3⅝	63	34	6¾
40	22	3⅞	65	35	7
42	23	4	67	36	7¼
44	24	4¼	69	37	7½
46	25	4½	71	38	7⅞
48	26	4¾	73	39	8⅛
50	27	5	75	40	8½

SIMPLIFIED TABLE FOR MANUFACTURING SYRUP

This table is based on using 100 pounds of sugar and sufficient water to make any of the below desired strengths.

Baumé Wanted	Lbs. of Sugar	Added Water		Syrup Obtained		Baumé Wanted	Lbs. of Sugar	Added Water		Syrup Obtained	
		Gallons	Ounces	Gallons	Ounces			Gallons	Ounces	Gallons	Ounces
40	100	3	119	11	67	29	100	10	46	17	107
39	100	4	56	11	123	28	100	11	20	18	87
38	100	4	113	12	52	27	100	12	7	19	74
37	100	5	41	12	114	26	100	13	3	20	70
36	100	5	106	13	36	25	100	14	8	21	69
35	100	6	49	13	118	24	100	15	20	22	83
34	100	6	119	14	61	23	100	16	44	23	102
33	100	7	68	15	8	22	100	17	82	25	13
32	100	8	23	15	84	21	100	19	8	26	72
31	100	8	111	16	47	20	100	20	79	28	13
30	100	9	74	17	10						

This table will yield approximately 10 gallons of syrup corresponding to the desired Baumé.

Bé. Syrup Wanted	Weight of Sugar, Lbs.	Amount of Water		Yield, Gallons	Bé. Syrup Wanted	Weight of Sugar, Lbs.	Amount of Water		Yield, Gallons
		Ounces	Gallons				Gallons	Ounces	
20	35	7	48	10	31	60.5	5	48	10
21	37	7	16	10	32	63.5	5	32	10
22	40	7	0	10	33	66	5	0	10
23	42	6	112	10	34	69	4	96	10
24	44	6	80	10	35	72	4	80	10
25	46	6	64	10	36	75	4	48	10
26	49	6	48	10	37	77	4	16	10
27	51	6	16	10	38	82	4	0	10
28	53	6	0	10	39	85	3	96	10
29	56	5	96	10	40	86	3	48	10
30	58	5	80	10					

The following table uses a 33° Bé. syrup, from which can be made a syrup of lower concentration.

Bé. Syrup Wanted	Use 33° Bé. Syrup	Water to Add Ounces	Amount of Syrup Made
20	1 gallon	110	1 gallon 110 ounces
21	"	97	" 97 "
22	"	85	" 85 "
23	"	74	" 74 "
24	"	64	" 64 "
25	"	55	" 55 "
26	"	46	" 46 "
27	"	38	" 38 "
28	"	30	" 30 "
29	"	23	" 23 "
30	"	17	" 17 "
31	"	11	" 11 "
32	"	6	" 6 "

The following table uses a 36° Bé., from which can be made a syrup of lower sugar concentration.

Bé. Syrup Wanted	Use 36° Bé. Syrup	Water to Add Ounces	Amount of Syrup Made
20	1 gallon	140	2 gallons 12 ounces
21	"	126	1 gallon 126 "
22	"	112	" 112 "
23	"	100	" 100 "
24	"	88	" 88 "
25	"	78	" 78 "
26	"	68	" 68 "
27	"	59	" 59 "
28	"	51	" 51 "
29	"	43	" 43 "
30	"	36	" 36 "
31	"	29	" 29 "
32	"	22	" 22 "
33	"	16	" 16 "
34	"	11	" 11 "
35	"	5	" 5 "

PERCENTAGE OF SUGAR IN SOLUTION AT A GIVEN TEMPERATURE

Percentage of Sugar	Percentage of Water	Temperature Degrees Fahrenheit	Percentage of Sugar	Percentage of Water	Temperature Degrees Fahrenheit
%	%		%	%	
67.25	32.75	220	85.20	14.80	239
75.20	24.80	225.5	85.80	14.20	240.8
80.00	20.00	230.8	86.50	13.50	242.6
82.20	17.80	233.6	87.20	12.80	244.4

THE PRINCIPAL STAGES OF SUGAR BOILING

Syrup	at	220	Degrees	Fahrenheit
Thread	"	225	"	"
Pearl	"	230	"	"
Blow	"	235	"	"
Soft Ball	"	245	"	"
Hard Ball	"	255	"	"
Soft Crack	"	280	"	"
Hard Crack	"	312	"	"
Caramel	"	350	"	"

CARAMEL SUGAR COLOR

Simple Sugar Syrup	10 lb.
Ammonium Carbonate	25 g.
Ammonia Water, 28 Degrees	15 g.

While bringing the sugar syrup to a boil, add the ammonia water with stirring. Now add the ammonium carbonate, previously dissolved in a little warm water, continue heating syrup until the temperature reaches 350°–450° F. Stir the contents continuously throughout the heating period.

CHAPTER XI

FRUITS, VEGETABLES AND FRUIT JUICES

Frequently, fruit that has a very attractive appearance may turn out to be of poor quality and have defects and blemishes hidden beneath the surface. To the inexperienced user of fruits and vegetables, the text that follows should be invaluable, both from the standpoint of judging quality and economy.

FRUITS

APPLES

The market supply of apples come from many distant States as well as from nearby districts, the largest shipments being made from Washington, New York, Virginia, Idaho, California, and Oregon. The Gravenstein a late summer and early fall apple, is the only California apple found generally in eastern markets.

QUALITY

Firm apples of good color and flavor are desirable. Immature apples lack color, are poor in flavor, while over-ripe apples yield to slight pressure, and the flesh is often soft, mealy and lacking in flavor. Sometimes the flesh of an apple is mealy or brown (this condition is known as internal break-down); such apples are usually wasteful and should be avoided. This condition is not always apparent on the surface, but the soft mealy condition of the flesh causes it to yield to pressure. Internal break-down may be due to various causes—over-ripeness, delay in placing in storage, holding too long in storage or unfavorable storage conditions, etc. Summer and fall varieties are more or less susceptible to this defect, particularly at the end of the seasons.

Apples that have been slightly frozen, but have received no other injury, usually recover their healthy condition. Their qualities as food are not affected, but their keeping qualities are somewhat impaired. When apples have been severely injured by freezing or bruising, the skin appears brown and water-soaked and is often tough and leathery because of the thick layer of flesh, adhering to it. The flesh is brown at point of injury and may be either dry and mealy, or watery and mushy, depending on the severity of the injury. Severely frozen apples do not recover

their earlier healthy conditions; they continue to deteriorate and, in addition, are very susceptible to decay organisms.

APRICOTS

Apricots are usually picked when slightly immature in order that they may reach the market in good condition. The finest quality and best flavor are found only in fruits that have ripened on the tree. Because of their extreme perishability, such fruits are difficult to ship and are usually found only in markets adjacent to the district in which they are grown.

QUALITY

Well-matured apricots are plump, fairly firm, uniformly golden-yellow in color, with a juicy flesh, and of good flavor. Immature apricots are usually greenish-yellow in color, the flesh is too firm, and by the time they get to market more or less shriveling is evident; the typical apricot flavor is lacking.

AVOCADOS OR ALLIGATOR PEARS

The avocado, known as "the salad fruit of the tropics," is marketed to a considerable extent under the trade names of Flavocado and Calavo, the former being a contraction of Florida avocado and the latter a contraction of California avocado. Avocados vary greatly in shape, size, color, and appearance. The shape may vary from spherical to pear or bottle shape, the size may range from 5 to 6 ounces to 2 or 3 pounds. The skin may be almost paper thin and relatively smooth, or it may be thick and smooth, or it may be leathery, rough, and shell-like. In color, the fruits may vary from green to a dark mahogany or almost black. No constant relation has been found between color and flavor or between color and texture of flesh.

The softening of firm avocados may be hastened by keeping the fruit for 2 or 3 days in a warm humid place. Softening may be retarded by keeping the fruit in a cool dry place at a temperature not below 42° F. Exposed to the average summer temperature, firm avocados will soften in 4 to 5 days.

QUALITY

Heavy, medium-sized avocados which have a bright fresh appearance and which are fairly firm or are just beginning to soften, usually are the most desirable. After a little practise the "feel" of the fruit will indicate this condition. The texture of the flesh should be soft, buttery, or marrowlike; such fruit usually has a high oil content and a rich, delicate,

nutlike flavor. Avocados whose flesh does not have a buttery smoothness may have a flat watery taste.

BANANAS

Bananas are one of the few fruits that reach their best quality and flavor after being harvested in the green state. If allowed to ripen on the plant, the fruit is insipid and of poor flavor. A banana is said to be "full" when the individual fruit is plump or well-developed; it is said to be "thin" when it is poorly developed.

QUALITY

With bananas, ripeness is indicated by the color of the skin. The fruit is of a green color when shipped to market, where it is ripened in storage rooms, and takes on a yellow or red color depending upon variety. Good eating quality is indicated when the solid red or yellow color of the banana is tinted with brown and flecked with small brown specks. At this stage, the flesh is mellow and the flavor fully developed. Bananas with tips still green or those which are of a solid yellow or red color from stem to tip have not developed their full quality for eating, but are good for cooking.

Poor condition is indicated by a badly discolored skin and a soft, mushy, sometimes discolored flesh. In some instances, the skin may be entirely brown or almost blackened, and yet the flesh may still be in prime eating condition if it is fairly firm and not discolored.

Bananas that have become too cold will not ripen properly, will not develop the bright yellow color of prime fruit, and will usually be of poor flavor.

BLACKBERRIES, DEWBERRIES, LOGANBERRIES, AND RASPBERRIES

QUALITY

Quality in this group of fruits is indicated by a bright, clean, fresh appearance combined with a solid full color and a plumpness of the individual berry. Good berries should be free from dirt, trash, moisture, and adhering caps.

Over-ripe berries usually are very dull in color, soft, and sometimes leaky. Such fruit is wasteful and is not always desirable. Natural breakdown, decay, bruising, and crushing, may cause berries to be soft and leaky.

Wet or leaky berries should be avoided. A leaky condition is indicated by stained containers and by the general appearance of the fruit. Some-

times the stains on the containers are plainly evident, but at other times they are not seen until the container is tilted so that the side is exposed. Leaky, soft, or damaged berries are not always seen in a casual examination for they may be at the bottom or in the center of the container.

Decay can be easily detected by the presence of molds on the surface of the berries. Berries with the caps attached may be immature, since the caps usually adhere firmly to immature fruits, but not to mature fruit.

A berry that has a number of cells or drupelets that are green or off-color when the rest are of the normal ripe color will not have as good flavor.

BLUEBERRIES AND HUCKLEBERRIES

QUALITY

Blueberries and huckleberries that are plump, of fresh appearance, clean, dry, free from leaves and trash, fairly uniform in size, and of a deep, full, color throughout the lot, are usually of good quality. Ripeness is indicated by the color, which may be blue, black, bluish-black, or purplish. The berries may be covered with more or less bloom depending on the variety. Generally the distinction between blueberries and huckleberries is on the basis of the seed, blueberries having small inconspicuous seeds and huckleberries having very prominent seeds which make them less desirable for consumption.

Decay is usually indicated by the presence of molds. Freedom from moisture is essential to good quality berries. Moisture may be caused by natural break-down, decay, or some form of mechanical injury and should be looked for carefully. Over-ripe fruit has a dull, lifeless appearance and is often soft and watery. Berries held long after picking have a similar appearance and may be more or less shriveled.

CHERRIES

Sweet cherries are grown mostly in the Western States, but are also grown to some extent in the Eastern States. The important varieties are: (light fleshed) Napoleon, Royal Ann; (dark fleshed) Black Tartarian, Bing, Republican, Lambert, Windsor, and Schmidt.

Sour cherries are produced mostly in the Eastern and Great Lake States. The important varieties are: Montmorency, English Morello, and Early Richmond.

Sweet cherries are used primarily for eating fresh while sour cherries are used primarily for culinary purposes, including sauce and pie making. The season extends from May through August.

QUALITY

Good quality in cherries is indicated by bright fresh appearance, plumpness, and good color. Well-matured cherries are plump, fairly firm, well colored for the variety, juicy, and usually have a well-developed flavor. Immature cherries are usually smaller than the average ripe cherries found in the container. They are frequently hard and of poor color, lack juice and are likely to be very acid. Over-mature or stale fruits are generally soft and dull in appearance. They may be more or less shriveled, and may be leaky. Such fruit is wasteful and may prove to be costly; a close examination should be made for worm injury.

Decay in the form of small, brown, circular spots is sometimes found; wherever possible it should be avoided. Decay and other forms of damage are often indicated by damp, stained, and leaky boxes. Cherries that have been bruised or otherwise mechanically injured are not desirable. The quality may be affected through molds which develop readily at the point of injury.

CRANBERRIES

Cranberries vary in size and color according to the variety. They are rarely sold to the consumer under variety name. The most common types on the market are the rather large bright-red fruit and the small darker kinds, which are somewhat sweeter than the lighter colored berries. Cranberries are generally sold by weight and are on the market from fall until the end of the winter.

QUALITY

A fresh plump appearance, combined with high luster and firmness, indicates good quality in cranberries. Poor quality and condition is indicated by shriveling, dull appearance, and softness. Cranberries that show moisture are usually leathery, tough, and sticky, and the flesh may be discolored.

FIGS (Fresh)

Figs are produced mainly in California, the southeastern states, and Texas. Because of their highly perishable nature, only a small percentage of those produced are shipped fresh.

The important varieties grown in the southeastern states are: Brown Turkey, Brunswick, Celeste, and Magnolia. The Lob, Inger, Kadota, Mission, and Adriatic are the important varieties grown in California.

QUALITY

Fresh figs must be fully ripe to be of good quality. A ripe fig is fairly soft or soft to the touch, and will vary in color from a greenish-yellow to purplish, or almost black, depending on variety. Varieties vary in size; therefore, size cannot be used as a method of judging maturity. Ripe figs sour and begin to ferment quickly, and fermentation proceeds rapidly. A characteristic odor is noticeable when figs begin to sour. Bruised or mechanically injured fruit should be avoided, for such fruit breaks down very quickly.

GRAPEFRUIT

Grapefruit is received on the markets from Florida, Texas, California, Arizona, Porto Rico, and Cuba (including the Isle of Pines). One of the most important varieties is Marsh (Marsh Seedless), which is practically a seedless fruit. Grapefruit often has a discolored appearance caused by the normal yellow color being overcast by a reddish-brown or reddish-yellow color, such discoloration being known as "russeting." Grapefruit is called "bright" when the surface of the fruit shows very little russeting, and "russet" when most of the surface of the fruit shows considerable russeting.

QUALITY

Grapefruits of good quality are firm, but springy, to the touch, not soft, wilted, or flabby, well-shaped, and heavy for their size. Fruits heavy for their size are usually thin-skinned and contain more juice than those that have a coarse skin or are puffy or spongy.

Generally speaking, most of the defects found on the grapefruits in the market (such as scale, scars, thorn scratches, and discoloration) are minor in nature; they affect appearance and not eating quality.

GRAPES

Grapes usually found in the market are of two very distinct types—the American, grown mainly in the Eastern and Central States, and the European or vinifera, grown chiefly in California. The muscadine type is grown in the South Atlantic and Gulf States but is not shipped to any extent.

Western grapes shipped largely from California, usually have a higher sugar and solids content, and in many cases are larger than the eastern type. The skin and pulp of the western type do not separate, but the seeds separate readily from the pulp. Some varieties of western grapes were planted for table use and others for juice. The more popular vari-

eties of western table grapes are: Flame Tokay, Malga, Emperor, Cornichon, and Sultanina (Thompson Seedless).

Eastern grapes are sold indiscriminately for both table and juice purposes. The eastern type is shipped from many sources, but the largest supplies are received from New York, Michigan, and Pennsylvania. The most common varieties are Concord, Catawba, Moore Early, Worden, Niagara, and Delaware. The Concord is used most extensively for juice purposes.

QUALITY

To be of good quality, table grapes should have a general appearance of freshness. They should be mature, and the individual berries should be firmly attached to the stems; mature grapes are usually plump.

For juice purposes, maturity is the most important factor of quality. No consideration need be given to compactness of the bunches or shattering of the berries from the stems provided the berries are not shriveled or dried.

LEMONS

California produces most of the lemons grown in this country. In addition to the California supply, many have until now been received from Italy. The California lemon is usually larger and smoother than the Italian.

QUALITY

Deep yellow colored lemons are usually relatively mature and are not so acid as those of the lighter or greenish-yellow color; they are also generally thinner skinned and may have a relatively larger proportion of juice but they are not so desirable since lemons are wanted for their acid flavor.

LIMES

QUALITY

Limes that are green in color and heavy for their size are the most desirable. Deep yellow colored fruits do not have the desired acidity.

Limes often become spotted with purple-to-brown-colored and irregular-shaped spots. Sometimes the whole fruit turns brown. This is the result of a defect known as scald. Such fruit has a poor appearance and brings a lower price than sound fruit, but in many cases the flesh is unaffected, although occasionally a tainted, moldy taste can be detected immediately below the spots.

ORANGES

The oranges from California and Florida constitute by far the greater part of the market supply. Some importations are received, as well as shipments from Texas, Arizona, Alabama, Mississippi, and Louisiana. The leading varieties shipped from California are the Washington Navel and the Valencia.

The Washington Navel season begins in November and continues to about May, when the Valencia season starts and continues throughout the summer and fall.

The greatest supply of Valencias begins in June and continues to about July, when it slackens; the supply grows heavier again in September, continuing until about November. Tangerines, satsumas, King, and mandarin types and varieties come chiefly from the Gulf States. The California orange is usually of a deeper color than the Florida fruit. The Valencia has from 1 to 5 or 6 seeds, whereas the Washington Navel is seedless. Generally, the skin of the Washington Navel is thicker and may be rougher than that of the Valencia, and the segments are more easily separated.

Florida and Texas oranges are often designated as "bright" or "russet," depending upon the extent of the russeting or discoloration of the surface. (The russeting does not affect the flavor.) California oranges are not subject to russeting.

QUALITY

Oranges of the best quality are firm, heavy, have a fine-textured skin for the variety and are well-colored. Such fruits (even with a few surface blemishes, such as scars, scratches, and slight discolorations) are much to be preferred to oranges that have a badly creased skin, or are puffy or spongy, and light in weight.

Puffy oranges are likely to be light in weight, lacking in juice, and of generally poor quality. Exceptions occur in the tangerines (of which Dancy is the principal variety), satsumas, King, and mandarin types and varieties. These oranges are usually thin-skinned, and are usually oblate or decidedly flattened at the ends. The skin is easily removed; there is little coarse fibrous substance between the skin and the flesh, and the segments of the fruit separate readily. The flavor is distinctive; the aroma is pungent and pleasant. Because of the looseness of the skin these oranges are likely to feel puffy; therefore, judgment as to quality should be based mainly on weight for size and deep yellow or orange color of the skin.

The fruit is sound when shipped, but sometimes decay develops before

the fruit reaches the consumer. When present, decay is usually present in the form of soft areas on the surface of the fruit, which appear to be water-soaked; these areas may be covered by a mold. In the early stages of development, the skin in the affected area may be so soft and tender that it breaks easily under pressure. Oranges that have been mechanically injured should be carefully examined. Decay may be present at the point of injury, and decay organisms may easily find entrance to the flesh of the fruit. Wilted, shriveled, or flabby fruit is sometimes found, age or injury often causing these conditions. Oranges so affected are not desirable.

PEACHES

There are two classes of peaches—white-fleshed and yellow-fleshed; both classes have varieties that are "clingstones" and "freestones." The freestone varieties of both classes are most popular for dessert, home canning, and general culinary use. The "clings" are not so popular for dessert but are used to some extent for slicing and home pickling, and chiefly for commercial canning.

Peaches for home canning should be firm and ripe. Generally, the yellow-fleshed midseason and late varieties (such as Elberta, Salwey, J. H. Hale, Late Crawford, and Smock) are preferred, although sometimes personal preference calls for a white-fleshed peach (such as Belle, Hiley, and Champion).

QUALITY

Quality in peaches is indicated by the general appearance and firmness of the flesh. A peach of fine quality should be free from blemishes, have a fresh appearance, a ground color that is either whitish or yellowish, sometimes combined with a red color or blush depending on the variety. The red color or blush alone is not a true sign of maturity, the flesh should be firm.

PEARS

The Bartlett, a midseason pear, is one of the leading dessert varieties and is used extensively for domestic and commercial canning. Clapp Favorite (an early-season pear), Bosc, Comice, and Seckel (midseason pears), Anjou and Winter Nelis (late-season pears), are some of the varieties used for dessert purposes. In the greater part of the central and southern states none of these can be grown successfully because of pear blight. The coarser varieties—Keiffer, Garber, and Le Conte—are somewhat resistant to blight and furnish large supplies of cheap fruit of good size, extensively used for canning, preserving, and fresh stewed fruit.

Pears are normally picked when slightly immature and are ripened in a cool dark place. The flesh of storage-ripened pears is usually of fine texture, while that of tree-ripened fruit is often coarse and, in some varieties, gritty.

QUALITY

Pears that are firm, or fairly firm, but not hard, free from blemish and clean, not misshapen, wilted, or shriveled, are generally of good quality. Some varieties are in prime condition while still a green or greenish-yellow color; others may be yellow and yet be too immature for eating.

Pears that are soft or that yield readily to pressure at the base of the stem are usually mature and ready for immediate consumption, but are too ripe to keep for future use.

PINEAPPLES

The only production of pineapples in continental United States is in Florida, the chief part of the crop being imported from Porto Rico, Cuba, Bermuda, Costa Rica, and the Bahamas. They are picked in a slightly immature state so they will reach the markets in good condition.

QUALITY

Color and odor are the factors indicating quality in pineapples. A ripe pineapple in good condition has a fresh, clean appearance, and has a distinctive dark, orange-yellow color combined with a decidedly fragrant odor. The "eyes" are flat and almost hollow. Usually the heavier the fruit in proportion to its size, the better the quality, provided the fruit is mature. Pineapples may lose moisture, particularly if held in a relatively dry atmosphere. The fruit remains firm as it dries out, if not affected by decay; but it shrinks in size, and the outer surface develops a poor and darkened color.

PLUMS AND PRUNES

The leading dessert varieties of prunes are: Italian Prune and Agen or French. The leading dessert plums are Burbank, Bradshaw, De Sota, Golden Drop, Jefferson, Reine Claude (Green Gage), Diamond, Wickson, Tragedy, Santa Rosa, and Kelsey.

For culinary purposes the leading varieties are: Lombard, Golden Drop, Grand Duke, Italian Prune, and Reine Claude (Green Gage). Varieties of the Damson type, because of their tart flavor, are especially desirable for jam and jelly making.

A prune is a variety of plum which is suited for drying purposes. Such plums can be dried without removal of the pit and without fermentation

of the flesh. A ripe fresh prune can be separated from the pit like a freestone peach, but a plum cannot be opened in this way. Ripe fresh prunes are superior for canning.

QUALITY

Plums and prunes of good quality are plump, clean, of fresh appearance, full colored for the variety, and soft enough to yield to slight pressure. Fruit that is shriveled usually has flesh of a leathery texture and is generally poor in flavor. Plums and prunes that have growth cracks should be examined carefully since these cracks, unless well healed, provide means by which decay organisms may enter the fruit.

QUINCES

Most of the quinces found on our markets are produced and sold locally, but some shipments are made from California and New York. Most varieties have a heavy fuzz over the outer surface of the fruit. Usually this is rubbed off when the fruit is packed, and its general appearance thus improved. Sometimes this is not done, and in the later handling some of the fuzz is removed, leaving the fruit, even though it is of good quality, with a generally poor and often dirty appearance.

Quinces are in season in the fall and are usually sold by measure, for preserving, flavoring, and jelly making. Since the entire fruit including the core is used for jelly, wormy fruit causes great waste in trimmings.

QUALITY

Quinces of good quality are firm to hard, free from blemish, and of a greenish-yellow or golden-yellow color. Immature quinces are hard and green, very astringent, and when cooked, lack the peculiar quince flavor. Usually such fruit wilts and shrivels if kept for any length of time.

STRAWBERRIES

Large strawberries because of their size and generally attractive appearance are preferred for dessert purposes, but size is no indication of flavor, which varies with the variety. There are many varieties of strawberries, those grown locally or in nearby districts being preferable, especially for canning, preserving, etc.

The varieties commonly found in markets are: Klondike, Missionary, Howard 17 (Premier), Dunlop, Aroma, Chesapeake, Marshall, Clarke, and Blakemore, a new variety which is gaining rapidly in popularity.

QUALITY

Quality in strawberries is indicated by the general appearance. Strawberries should be of a fresh, clean, bright appearance, have a full solid red color, be free from moisture, dirt, and trash, and the cap should be attached. Small misshapen berries or nubbins usually are of poor quality and flavor, and often have a small, hard, green area.

Over-ripe strawberries, or those that are not fresh, have a dull lusterless appearance, are sometimes shrunken, and are likely to be wet or leaky; such berries are wasteful. The presence of leaky or damaged strawberries is often indicated by a stained container. Decay is easily detected through the presence of mold on the surface of the berries. It may be found anywhere in the container and is not always evident in the top layers.

Strawberries without the caps should be carefully examined, since they may have been roughly handled, or may be over-mature. Such berries are likely to break down rapidly and be wasteful.

VEGETABLES

ARTICHOKES

Two very unlike vegetables are called artichokes—one known as the French or globe, the other known as the Jerusalem artichoke. The French or globe artichoke is a plant allied to the thistle, the edible part of which is the large unopened bud which, if not cut from the plant, opens into a flower. The globe artichoke is very perishable and becomes tough with age.

The Jerusalem artichoke is a type of plant related to the sunflower and grown for the thick, potato-like underground tubers. These tubers, which constitute the edible part, are now little used except occasionally for pickling and as a substitute for potatoes.

QUALITY

A compact, heavy, globular, plump globe or French artichoke, which yields slightly to pressure, and which has large, tightly clinging, fleshly leaf scales of a good green color, is the most desirable. Freshness is indicated by the green color which, with age or injury, becomes brownish.

Over-maturity is indicated when the artichoke is open or spreading; the center may be fuzzy and of a dark pink or purple color, the tips of the scales are hard. When cooked the flavor is strong and the scales are tough and woody.

BEETS

The early or new-crop beets are usually marketed in bunches, three to five to the bunch, with the tops attached, either full size or cut back to 6 or 8 inches in length. Occasionally small quantities of the new crop are shipped loose to local markets; in such cases, the tops are cut back to within an inch or two of the beet. The fresh green tops of bunched beets make excellent greens; leaves that are discolored and ragged, with tough stems, are undesirable for this use.

The late-crop beets are usually marketed with the tops removed. These beets are suitable for storage; those that have not been washed are likely to keep well if storage conditions are good. Medium-sized beets of the late crop are less likely to be tough or woody than are the large or very small ones. Beets that are marketed with the tops removed are usually sold by weight and in some instances by measure.

QUALITY

Good beets should be smooth and free from blemish. Beets that are rough or ridged or that have deep growth cracks are wasteful and may be tough and woody. It is expected that beets will have some soil on them, but those that are caked with it are difficult to clean.

Soft, flabby, or shriveled beets are wasteful and usually poor in flavor. Examination may reveal decay, which generally appears as rot. Bunched beets that have remained too long in the field and have become tough or woody can often be recognized by a short neck covered with deep scars, or by several circles of leaf scars around the top of the beet. Only the early or smaller leaves will have been shed by a tender beet. Fresh condition of the leaves alone should not be considered as an indication of the quality of the beet. The roots or beets may be of excellent quality, while the tops may be badly wilted or otherwise damaged.

BEET TOPS

Beet tops are usually supplied to markets from local sources. They consist chiefly of the plants that have been pulled out to thin the rows and, generally, the whole plant is used. Beet tops are usually sold by weight.

QUALITY

Beet tops of good quality are young, fresh, tender, and clean. Old, coarse, heavy-veined, heavy midribbed leaves are usually tough and generally undesirable. Flabbiness and wilting are the factors of condition that most frequently affect beet tops, but freshness can be restored if the

tops are not old and the condition is not too far advanced. Occasionally beet tops may be found to be in a slimy condition; such stock should be avoided.

CABBAGE

There are several market types of cabbage: the pointed, Danish, domestic, savoy, and red. The pointed type is the familiar early or "new" cabbage and includes the varieties that normally develop conical or pointed heads. The Danish type includes varieties maturing late which normally develop hard tight-leaved compact heads. A head of Danish-type cabbage, even after being trimmed, appears tight and smooth-leaved around the basal portion and, when viewed from the stem end, is circular and regular in outline. The domestic type includes varieties of cabbage that normally develop heads, either round or flat in shape, and less compactly formed than those of the Danish type. This type includes early, midseason, and medium-late varieties. The savoy types are finely crumpled-leaved varieties which are roundish or drumhead in shape and are usually late in maturing. The red type includes all red varieties.

Early or new cabbage shipped from the southern sections during the winter months is frequently harvested before the heads are firm. It is not trimmed so closely as the late or main crop and can be readily identified by the conical, or pointed head and comparatively smooth deep-green leaves. New cabbage that has not been properly handled soon loses its freshness. Freshness of appearance of the late or main-crop cabbage is not such an important factor of quality as in the early crop. Late cabbage out of storage may be trimmed down to perfectly white heads by the retailer and still be good.

QUALITY

Prime heads of cabbage should be reasonably solid, hard, or firm and heavy or fairly heavy for their size; they should be closely trimmed, that is, the stems should be cut close to the head, and all except three or four of the outer or wrapper leaves should be removed. Early or new cabbage usually is not so solid or firm as cabbage of the late or winter crop. Soft or puffy heads, although edible, are usually of poorer quality than those that are hard or firm.

CARROTS

There are two crops of carrots, early and late. The early or new carrots are usually marketed in bunches, three to five to the bunch, with the tops attached. The late crop is marketed with the tops removed. Carrots of the early crop, because they are usually harvested before reaching full

maturity, are generally smaller, and of a brighter color and milder flavor than those of the late crop.

Late-crop carrots are generally grown to full maturity and for this reason are generally of deeper color, of more pronounced flavor, but are sometimes coarser in texture than those of the early crop. In some varieties the heart may be tough and woody. The late crop is usually stored and marketed during the winter. Carrots are generally washed before being offered for sale, but often will be found with considerable soil adhering to them. This does no harm, but it mars the appearance and may possibly hide some defect.

Under present conditions of production and marketing, bunched carrots are on the market practically the whole year and are a strong competitor of the late or storage-crop topped carrots.

QUALITY

Good quality carrots are firm, clean, fresh in appearance, smooth, well-shaped and of good color. Usually (although not always true), poor color of carrots is associated with poor quality. The tops of bunched carrots should be fresh and green. The condition of the tops is an indication of quality, but it is not always a trustworthy one since the tops may be damaged and the roots still be in prime condition.

Carrots that are wilted, flabby, soft, or shriveled are undesirable, since they usually lack flavor. Those that are excessively forked or pronged, rough, or have deep growth cracks, are wasteful. Carrots showing excessively thick masses of leaf stems at the point of attachment, or "neck," usually have undesirably large cores or hearts. Decay is easily noticed, since it usually appears as soft or watersoaked areas which may be more or less covered with mold.

CORN

A slender ear of corn may have just as much kernel as a large coarse ear, owing to the variation in the size of the cob. Corn found in the markets is of two classes, sweet and field. The latter is usually an early maturing variety of field corn, and is known in some sections as "roasting ears." It may be as tender as sweet corn, but it never has a notably sweet taste.

The ears of sweet corn are usually smaller than those of field corn, and the husks are generally darker green in color with ribbonlike ends which hang free and give the ear a somewhat ragged appearance. The husks of field corn do not have ribbonlike ends; they taper and cling tightly at the top of the ear. The color of sweet corn may be either white or yellow,

depending on the variety; the field corn sold for cooking is usually white, but may be yellow.

QUALITY

A good ear of corn is one that has a fresh green husk and a cob that is well filled with bright, plump, milky kernels that are just firm enough to offer slight resistance to pressure. Dry, yellowed, or straw-colored husks are an indication of age or damage. Corn heats rapidly when packed for shipment; heating causes the yellowing and drying-out of the husk, as well as the toughening, discoloration, loss of flavor, and shriveling of the kernels. Corn that is too immature is unsatisfactory, since the kernels of immature corn are very small and soft and, when cooked, lack flavor. Worm injury is not serious when confined to the tips, since the injured portion usually can be removed with little waste, but it is more objectionable if it occurs along the side of the ear.

Corn should be cooked as soon as possible after being picked as it loses flavor very rapidly.

CUCUMBERS

Cucumbers for slicing purposes should be firm, fresh, bright, well-shaped, and of good color; the flesh should be firm and the seeds immature. Withered or shriveled cucumbers should be avoided, since their flesh is generally tough or rubbery and somewhat bitter. Over-maturity is indicated by a generally overgrown puffy appearance. The color of over-mature cucumbers is generally dull and not infrequently yellowed, the flesh is rubbery and tough, the seeds are hard, and the flesh in the seed cavity is almost jelly-like. Cucumbers in this condition are not suited for slicing but are excellent for certain kinds of pickles. Some varieties are of solid green color when mature enough for slicing, but usually a little whitish color will be found at the tip, with a tendency to extend in lines along the seams. These lines advance from pale green to white and, finally, to yellow, with age.

Decay, when present, usually appears anywhere on the surface as a dark sunken irregular area.

ONIONS (DRY)

Two general classes of onions grown in the United States are found on the markets, the large, mild-flavored and the medium-sized, strong-flavored variety. The former are the Bermuda and the Spanish or Valencia types and the latter the domestic or American type.

The Bermuda, a flat early type, is found on the market from March to June. Usually two varieties are available, the white and the yellow; al-

though, occasionally a red type may be seen. The most popular sizes are those about 2½ to 2¾ inches in diameter.

The Spanish or Valencia type is a large, mild, sweet onion which may be either light yellowish-brown or white in color. It is usually globular or somewhat oval in shape.

The domestic or late-crop onions are practically all globular and have yellow, red, or white skins; occasionally brown-skin varieties are seen. They usually keep well and are found on the market the entire year. The white varieties are usually milder in flavor than the others.

Imported onions are available during most of the year. The Spanish variety is very mild, large in size, oval in shape, yellow skinned, and has sweet flesh. The Egyptian onion is usually darker in color and stronger in flavor than the Spanish.

"Boilers" is the term used for domestic and Bermuda-type onions that range from 1 inch to 1⅝ inches in diameter. Pickling onions are those that do not exceed 1 inch in diameter. White varieties of this size are frequently in demand, particularly in the fall. Large onions of the Spanish type are sold by the unit; those of the Bermuda and domestic types are usually sold by weight. Sometimes the pickling sizes are sold by measure.

QUALITY

Bright, clean, hard, well-shaped, mature onions with dry skins are usually of good quality. Onions in which the seed stem has developed are undesirable. Usually the neck of such stock is thick and a tough woody condition of the stem or neck is noticeable; the tough stem extends from the very base of the bulb, causing much waste.

Decay generally appears as a rot attacking either the outer scales or the scales in the center of the bulb, and may penetrate the bulb from the neck to the base. Moisture at the neck is an indication of decay.

Misshapen onions are sometimes found on the markets. The most common of these forms are known as "splits," or "doubles," and "bottle necks"—terms which are self-explanatory and which refer to shape only. Misshapen onions are objectionable mainly because of the possible waste in their preparation for table use.

ONIONS (GREEN), LEEKS, AND SHALLOTS

The green bunched onions may be any early onion, usually white, that is pulled before maturity, when it has reached the required size. The leek, a plant similar to the onion, has broad dark-green leaves and a straight, thick, white neck about 1 inch or more in diameter. It has an agreeable but not strong flavor and is used cooked or raw, usually for

flavoring. The shallot is a species related to the onion that grows in oblong clusters which are pulled before maturity. The mature shallot is used chiefly for flavoring.

The green onions, leeks, and shallots, as they appear on the market are merely blanched leaf bases or incompletely developed bulbs, together with the green portions of the leaves. They are usually sold in bunches. The green onion differs from the shallot in that the onion is somewhat bulbous at the base, whereas the shallot is practically a straight stem. The leek, much larger than the shallot, has a rounded but not a bulbous base.

QUALITY

Green onions, leeks, and shallots of good quality have green fresh tops, and medium-sized necks which are well-blanched for at least 2 or 3 inches from the root and which are young, crisp, and tender. Bruised, yellowed, wilted, or otherwise damaged tops are not attractive and may indicate poor quality or damaged necks. The wilting and yellowing of the top may indicate age and flabby, tough, fibrous necks. This condition can be ascertained by puncturing with the thumb nail and twisting. Bruised tops are unimportant if they can be trimmed without waste or without spoiling the appearance for table use.

PEPPERS

Two types of peppers are found on our markets, the sweet type and the pungent or hot type, to which the chili or cayenne peppers belong.

Sweet peppers are usually of the bell or bull-nose type. They are shipped usually when mature but still green in color. They change from a deep-green to a bronze-red or bright-red color as they continue to mature. Sweet peppers are offered for sale in both the green and the red stages of maturity. The varieties vary in shape—some are long and somewhat slender and pointed, others are short, chunky, and wide. The latter type are more desirable for stuffing.

The pungent or hot varieties are found on the markets in either the green or the red stage. They vary from the small chili to the large sizes approaching the bell type. As a rule, they are not so thick-fleshed as the sweet pepper and are generally used in the red stage. The chili and cayenne peppers are sometimes threaded on strings and dried before being offered for sale. Sometimes the whole plant is pulled up with peppers attached, dried, and then sold.

QUALITY

Peppers to be of good quality, must be mature, firm, well-shaped, thick-fleshed, and of good color and fresh appearance. Immature peppers are usually soft, pliable, thin-fleshed, pale in color, and have undeveloped seeds. In mature peppers the seeds are hard and the pepper may yield to slight pressure, but it should not be shriveled, limp, or pliable. Shriveling or softness may indicate age or immaturity. Peppers that have been kept too long are usually in this condition and are often of poor color.

Constricted, crooked, deformed peppers, provided they are of good quality otherwise, are objectionable only because of their limited uses and the possibility of waste. Peppers that have surface blemishes should be examined carefully. Such stock may prove to be wasteful, particularly if the blemish passes through the fleshy wall. Sometimes peppers are found on which there is a bleached, discolored area that may be sunken or that may resemble a water-soaked blister. Such peppers should be avoided because they decay rapidly.

POTATOES

Potatoes of the same variety may be had as either new or old stock during the late spring or early summer.

New or early potatoes are dug before they reach full maturity and are marketed as soon as dug. Because of the slight immaturity and the warm weather at the time they are dug and shipped, they will not stand rough handling and are more subject to injury than are those of the late crop. The skins are easily broken and often present a feathery appearance.

Potatoes of the late crop are usually more mature when dug. Most of this crop is stored and shipped during the winter and spring. Immature late potatoes are not often on the market; they may be detected by their feathery skins and frequently by a discolored appearance.

Until a comparatively short time ago washing or brushing dirt from potatoes was not considered profitable; such cleaning is now becoming a commercial practice in some sections, but it adds to the cost of preparation for market.

QUALITY

Potatoes that are sound, smooth, shallow-eyed, and reasonably clean are usually of good quality. Varieties vary considerably as to shape, size, and color of the skin, and cooking qualities. It is difficult for even the most experienced buyer to identify them. A mixture of varieties that are not similar as to cooking quality is undesirable. It is often economial to buy and cook a small sample before buying in quantity. Medium-sized

potatoes are usually the most desirable for general use, but selection on the basis of size should be governed by the use for which they are intended. Dirty potatoes are unattractive, but the presence of dirt does not injure the eating quality. However, wilted, leathery, discolored potatoes should be avoided, since they may have been dug up too early or injured by some other means.

Occasionally both new and old potatoes show a green color on some part of the surface, a condition known as sunburn. It is usually caused by long exposure to light which may have occurred in the field or in storage. Sunburned potatoes should be avoided as they usually have a bitter taste that makes them largely inedible.

Potatoes may sometimes have a hollow center known as hollow heart. The size of the cavity may be very small and cause no appreciable waste; or it may be very large, causing considerable waste. Another serious defect known as blackheart is sometimes found—a black, often slimy, center in the potato. It is usually the result of poor storage or shipping conditions. Hollow heart and blackheart are defects that can be detected only in cutting. Hollow heart is more likely to be found in large potatoes, but it may be present in potatoes of smaller sizes. Blackheart is very objectionable, particularly in potatoes used for baking.

Potatoes injured by freezing are sometimes found on the market during the winter. Bad cases are indicated by the potato being wet and leaky; or when cut across, it may show a black ring just within the outer surface. In such potatoes the flavor is usually affected, and the flesh turns dark in cooking.

Decay is one of the most serious defects. It may appear as either a wet or a dry rot, which may affect both the surface and the interior flesh. Sometimes the decay is so slight that it can be cut away with little waste. Another defect is caused by wireworms. Affected potatoes show numerous small perforations which may be so deep as to cause appreciable waste.

In the late spring or early summer, old potatoes may have a shriveled appearance, may be soft and spongy, or may even be sprouted. They are very wasteful and may not cook satisfactorily.

Badly formed or misshapen potatoes are sometimes offered for sale. They should be considered from the standpoint of the possible quantity of waste in preparing them for use.

SWEET POTATOES

There are two general types of sweet potatoes—those having dry, somewhat mealy, flesh when cooked, and those having a moist flesh and

high sugar content. The latter are commonly, but incorrectly, called yams on the markets.

The most common varieties of the dry type are Big Stem Jersey, Little Stem Jersey, and Yellow Jersey. These usually have a yellowish fawn-colored skin and a very light yellow flesh. The moist-fleshed varieties have skins that vary from whitish to a reddish color and flesh that varies from light greenish-yellow to a reddish or orange tint. The varieties vary in shape, and there is considerable variation of shape within the varieties. Nancy Hall and Porto Rico are the most important varieties of this type.

Sweet potatoes are shipped either as an early crop or are stored for use during the winter and, therefore, are found on the markets practically throughout the year. Maturity is of little importance, except that the early crop may be more readily bruised and skinned than those shipped later in the season. Sweet potatoes are very perishable when abused and are easily injured by careless handling. A mixture of varieties is not desirable because of the difference in flavor and color of the flesh and because of the lack of uniformity in cooking qualities.

QUALITY

Good sweet potatoes are smooth, well-shaped, firm, and of bright appearance. The most common defects are decay, misshapeness, and growth cracks. Badly misshapen potatoes and those with growth cracks are undesirable only from the viewpoint of waste in preparation.

Sweet potatoes affected by decay are objectionable, because the decay usually spreads rapidly and imparts a disagreeable flavor to the potato, even if the decayed portion is removed before cooking. Decay may appear either as a soft, wet rot or as a dry, shriveled, discolored, sunken area, usually at the ends of the potato, but it may appear anywhere on the surface. Another form of decay may appear as greenish (almost black) circular spots, varying from small to large. At times the spots are irregular, occuring in bruised and injured places.

Sweet potatoes sometimes are marked with small, dark, clay-colored spots which may unite and form large dark blotches. The spots are only skin deep and affect the appearance but not the flesh. Sweet potatoes that appear damp should be carefully examined—they may have been badly handled or frozen, or decayed specimens may be present.

TOMATOES

Tomatoes that are to be shipped long distances are picked when still green, but mature enough so that they will ripen properly after arriving at their destination. Such tomatoes have a dark, clear, shiny green body color, and the blossom end usually has a white or yellowish cast. They

are generally firm and have a polished surface. Immature fruit usually appears shriveled or is angular in form and has a whitish-green color.

Tomatoes can now be had throughout the year. In addition to the supplies received from distant sources, many markets are supplied with locally grown stock, either greenhouse or field-grown, according to the season. Tomatoes that have been picked green and ripened in the markets are less juicy than those ripened on the vine; therefore, the very best for fresh table use are to be had from the home-grown crop.

QUALITY

Good-quality tomatoes are mature, firm but not over-ripe, fairly well formed, plump, smooth, of good color, and free from blemish.

There are many defects in tomatoes which are serious only from the standpoint of waste in preparing for the table. Catfaces or scars around the blossom end are typical of the defects within this class. Tomatoes that are rough or irregular in shape may not be attractive in appearance; but for certain purposes they can be used with little waste.

Tomatoes that have been attacked by worms are very objectionable, especially if the worm has bored deeply. Those having growth cracks will seldom keep long, but are fit for immediate consumption. Puffy or watery fruit is usually of poor flavor and is wasteful; puffy tomatoes are usually angular in shape.

TURNIPS

Early turnips are usually sold in bunches with the tops attached, although sometimes the tops are cut back to about 6 or 8 inches. The early turnips are usually much smaller than those of the late or main crop, which is marketed with the tops removed. The early crop is marketed as soon as harvested, but much of the late crop is stored for shipment during the winter. Early or new turnips are shipped during the winter months, while the late or winter crop is still on the markets.

QUALITY

Turnips that are smooth, firm, with few leaf scars around the crown, and with very few fibrous roots at the base are usually of good quality.

The condition of the tops of bunched turnips is an indication of quality. The tops should be fresh, green, young, and turgid. Yellowed or wilted tops of bunched turnips may indicate damage of some kind, possibly caused by long keeping.

FROZEN FRUITS

FRUITS SUITABLE FOR FREEZING

Up to a decade ago, quick frozen foods were still novel, today the industry is growing very rapidly. Practically all fruits can be preserved by freezing, using a simple procedure. The manner in which this is followed through may determine the finished quality of the product. It is recommended that the fruit be carefully harvested, matured, and handled as little as possible while transporting to the freezing plant. The process of washing, steaming, peeling, or seeding the fruit must be accomplished quickly, and the handling done gently. Peaches, apples, pears, which may turn brown upon removal of their skins, should be treated with an anti-browning agent such as bisulphite of soda, sulphurous acid, or any one of the well-known organic reducing compounds before freezing. In the freezing of fruits, thickening agents are sometimes employed, e.g., pectin, alginates, gums, etc. The purpose of these additions is to prevent a complete collapse of the fibre structure during freezing and thawing out of the fruit. The packages in which cold packed fruit is sold should be made of moisture proof material, filled as completely as possible, and sealed air tight.

VEGETABLES SUITABLE FOR FREEZING

The young seeds of peas, beans, corn, tender young leaves of spinach, collards, turnip greens, kale, etc., are especially suitable for freezing; roots such as carrots, parsnips, beets are also well preserved by freezing. The vegetables should be prepared in the same manner as for cooking and then blanched and frozen. Only the highest quality of vegetables should be frozen; the less choice varieties and other mature or off grade products should be preserved by a less expensive method. Frozen vegetables at the present time are only in demand for a limited market that can afford to pay for quality.

Many vegetables are unsuitable for freezing, including cantaloupes, celery, kress, cucumbers, endives, lettuce, green onions, parsley, radishes, green peppers, sliced tomatoes and watermelons. This is due to the fact that these vegetables are usually served raw as a salad or dessert, and the freezing impairs the fresh flavor and destroys the crispness.

JUICES SUITABLE FOR FREEZING

In recent years citrus fruit juices have been frozen and their freshness and qualities retained throughout the year. The process of freezing juices is becoming a useful method for those manufacturers who produce the

juices as a by-product, opening up to them a new method of shipping. The flavor of citrus fruit juice and many other juices is retained longer if they are de-aerated immediately after pressing, and the containers are filled so as to leave as little head space as possible. When the fruits are crushed and pressed for their juices, it should be done quickly since exposure to air encourages oxidation and this, in turn, effects the color, flavor and taste.

Apple and peach juices turn brown, while cherry and other juices may go through some change; most of the berry juices, however, are stable. Briefly, the outline in freezing of juices is to weigh, wash, inspect, pulp, press, fill containers, freeze and then store them. Fruit juices are frozen rather easily by simply pouring them into containers and placing in a room at zero ° F. or lower. Freezing will be faster and the juice will be homogeneous if the filled containers are turned twice during freezing. The juice will not be quite as icy and the pulp will remain in suspension.

MEATS SUITABLE FOR FREEZING

Wrapped meat prepared in the best manner will keep for many months at zero ° F., the time depending on the kind of meat. Pork deteriorates faster than other farm produced meat and should be used within 4 to 5 months, since the fat tends to become rancid. Beef will keep for a year, while chicken and most fish will keep for much longer than a year. Meats should be de-boned, cut into pieces and suitable sizes for cooking, before freezing. Meats may be wrapped together, and the placing of cellophane between pieces will facilitate separation after freezing.

The drying out of meat while in storage may run as high as 10% in a year. Therefore, wrapping material which will not crack, become brittle, absorb water, blood, oil, grease, nor impart flavors or odors, should be used. The freezing of meats preserves the natural fresh qualities, reduces bacteria, tenderizes it and reduces the cooking time. Meat after thawing out will drip, the amount decreasing as the period of storage time increases; thus, well-tenderized meats lose less juices than those frozen immediately after slaughter.

DAIRY PRODUCTS SUITABLE FOR FREEZING

A cold storage temperature of 36 to 40° F. is desirable for bottled milk. A cream line will reach its optimum in 6 to 12 hours on pasteurized milk at this temperature. It is the opinion that freezing whole milk on the cooler coils lowers the quality of its flavor, as against quick freezing in containers in the absence of air. Sweet cream is the chief form in which dairy products are frozen. The storing of cream in paper containers results in a papery taste. To overcome this, containers free from traces of

cotton and iron should be used. The cream is pasteurized at 175° F. for 30 minutes, then homogenized, and 10% cane sugar or dextrose and a trace of salt added. After the cream is frozen, the foam is skimmed off and a ½ inch of water added to prevent exposure to the atmosphere. It is allowed to thaw very slightly at about 40° F. When the frozen cream thaws out, the water and milk solids are separated and not in their original form. Therefore, this cream will not whip well. The whipping qualities, however, may be improved upon the addition of 0.2 to 0.4% egg yolk.

FREEZING EGGS

Eggs may be frozen as the whole egg, yolks, or whites. These products keep in excellent condition for one year or more and are used almost exclusively by bakeries and ice cream manufacturers. The tendency of egg yolks to congeal on freezing may be corrected by mixing the product before freezing or by the addition of 2% glycerin. This addition produces a smoother mix of eggs, which quality is also imparted to bakery products. Frozen eggs are sold in 10, 20 or 30 pound containers.

In the process of food manufacturing the product is put through a number of treatments during which both chemical and physical changes take place. The chart below indicates only to a slight degree, since some of these changes take place during processing.

FRUIT JUICES

Many fruits, when fully ripened, are rich in juice, which, when pressed out, makes a delicious drink.

These fruit juices can be bottled for fountain or household purposes. Grape juice makes a good unfermented beverage, and so does a blend of sweetened blackberry and raspberry juices. In the last few years prune juice and pineapple juice have become popular in the home.

Fruit juices are rich in vitamins and mineral salts, and so are considered very nourishing, at the same time making a good beverage of the non-intoxicating type.

THE MANUFACTURE OF FRUIT JUICE

A problem with which the manufacturers of fruit juice frequently contend is cloudy juice. Such juices may be sparkling clear when bottles are filled, but upon standing a short while will again become cloudy. A fruit juice tastes best when it is first pressed from the fresh fruit. Treatment that is added sometimes injures its delicate taste and aroma. The important thing to retain in a bottled juice is its pleasing tasting qualities.

Summary of Changes in Dietary Value in Food Processing

Treatment	Mineral Constituents	Vitamin A	Vitamin B_1	Riboflavin	Vitamin C
Blanching in water	Considerable loss	No loss	Considerable loss	Considerable loss	Considerable loss
Blanching in steam	Little loss	No loss	Little loss	Little loss	Little loss
Sterilizing at 212° F.	Diffuse into liquid but remain in can	Little loss	Little loss	Little loss	No loss except by oxidation
Sterilizing at 240-250° F.	Diffuse into liquid but remain in can	Little loss	Considerable too much loss	No loss	Little loss except by oxidation
Freezing storage	No loss except in blanching	No loss	Little loss except in blanching	No loss except in blanching	Some loss on prolonged storage
Sun drying unsulfured fruits	No loss	Heavy loss	Some loss	No loss	Practically all lost
Sun drying of sulfured fruits	No loss	Slight to moderate loss	Nearly all lost	No loss	Slight to moderate loss
Alcoholic fermentation	Slight loss. Taken up by yeast.	None present in liquid	⅔ or more lost	Little loss	If SO_2 used loss is slight; otherwise heavy loss
Lactic fermentation	Slight loss. Taken up by yeast.	No data	Considerable loss to very little loss	Little loss	⅔ or more loss

The methods of clarifying fruit juice, so that no further cloudy effect takes place in the bottled juice, should not remove too much of the natural taste and body. The physical appearance is improved by making the juice clearer, but it does not improve the flavor.

Fresh fruit juices will spoil quickly, either through fermentation or molding, if nothing is done to prevent the growth of yeasts and molds. Yeasts and molds are usually killed by temperatures between 160°–170° F. If the juice is immediately transferred to containers, hermetically sealed, and then sterilized, it will not spoil, as long as the container remains closed. The containers should be pasteurized for 35 minutes at a temperature around 175° F. Too high a temperature of pasteurizing or too long a period of heating injures the fresh fruit flavor as well as imparting a cooked taste. Juices held in cold storage at 32° F. may begin to spoil after six months, but if maintained in a frozen condition below 32° F., will keep indefinitely. The flavor, however, may be slightly impaired as well as the color.

Chemical preservatives are also commonly used to preserve fruit juices. Sodium benzoate is allowed to the extent of $\frac{1}{10}$ of 1%, and must be declared on the label. Sulphurous acid is also used, but is efficient for only short time preservation. The sulphurous acid oxidizes to sulphuric acid. After several weeks practically all of the sulphurous acid is gone, especially with juice in wood-filled containers. Bottles and corks can also be sterilized or treated with antiseptics, so that the perfect filtered juice will not become infected with yeasts or molds after the bottles are filled.

Bottles can also be rinsed either in a solution of 25 parts per million of chlorine water and then allowed to drain, or in .025% solution of sulphurous acid (250 parts per million). Corks may be immersed in the latter chemical solution also, and then used after a short while.

FILTERING THE JUICE

Cloudy juice containing suspended particles and other impurities can be removed by the following methods:

1. Filtration—most commonly used and most satisfactory.
2. Centrifuging—clearing by centrifugal force.
3. Clarifying materials—such as gelatin, tannic acid, isinglass, egg albumen, casein, talc, bentonite, calcium sulphate.

In the third process the clarifying material is added to the juice, coagulates with the suspended cloudy substances, and then finally carries it down to the bottom of the container. These clarifiers have their advantages and disadvantages. Gelatin when used by itself is partly soluble

in juice. If used in conjunction with tannic acid, some of it may remain in solution if there is insufficient tannic acid to combine with it.

When used alone it has the other disadvantage of removing tannins, thus removing the natural color and flavor of the juice. When the proportion of tannin and gelatin is correct, a flaky precipitate immediately forms. This precipitate, as it settles, carries down with it a pectinaceous slime, bacteria, and gummy substances. The quantity of tannin naturally present in fruit juices varies, and in order to determine the correct amount of gelatin and tannin to add, it is necessary to make trial precipitations with small quantities of juice. To each of three jars add 1 quart of juice and 10 cc. of a 1% solution of tannic acid, mix thoroughly, and then add to each jar, respectively, 5 cc., 10 cc., and 15 cc. of a 2% gelatin solution. Mix the juice again and then allow to stand. After two hours the jar in which the best clarification has taken place is selected.

The fruit juice in the tank is now clarified by the addition of tannin and gelatin in the same proportion.

CLEARING THE JUICE WITH CHEMICAL COMBINATIONS

In using a combination of chemicals for juice clarification, the reaction yields a heavy rapid settling precipitate, which carries down with it the pectinaceous and gummy colloids. The chemical precipitate formed must be insoluble in the fruit juice, and should also be harmless. Such combinations are as follows:

1. Potassium aluminum sulphate and sodium carbonate.
2. Potassium aluminum sulphate and dibasic sodium phosphate.

The combination of 1 yields a dense white precipitate of aluminum hydroxide. Dissolve 4½ ounces of potassium aluminum sulphate in 1 pint of water and then stir it into 50 gallons of juice. Now dissolve 3 ounces of sodium carbonate in 1 pint of water, and add it with stirring to the same 50 gallons of juice. Allow the precipitate to settle. The clear juice is then siphoned out.

The combination of 2 yields a heavy flocculent precipitate of aluminum phosphate and aluminum hydroxide. Use by dissolving 3 ounces of potassium aluminum sulphate in 1 pint of water, and stir it into 50 gallons of juice. Now dissolve 3.3 ounces of dibasic sodium phosphate in 1 pint of water, and add it with stirring to the same 50 gallons of juice. Allow the precipitate to settle. The clear juice is then siphoned out.

FLOW SHEET IN MANUFACTURE OF JUICE

A. The fruit is sorted or examined on broad cotton or rubber belts, which slowly move past girls who remove bruised or blemished fruits.

B. Washing equipment is then used, similar to the rotary tomato washer, to improve the quality of the fruit before crushing. Berries which cannot stand rough treatment must either be rinsed by hand or washed under a gentle spray of water.

C. Crushing the fruit is the next step. The most satisfactory type of crusher for general use is that commonly used for apples under the name of "apple grater." The grater usually consists of a heavy steel cylinder, geared to revolve about 2400 times a minute, and grooved to receive knives, which are six or more pieces of tempered steel about 3/8 inch thick and having one edge cut to form teeth 3/8 inch square. The knives, adjustable by set screws, are usually set so that they project about 3/16 of an inch. One side of the cylinder housing is made up of the concave, consisting of three or four heavy curved iron plates, each attached by its top to the housing, and adjusted at the bottom by a heavy spring. When properly adjusted such a grater is much more efficient than any roller crushing device.

For grapes the best crusher consists of two corrugated or fluted metal rollers which revolve close together and towards each other, carrying downward between them and crushing the grapes that are fed into a hopper above. Connected with the crusher is a stemmer consisting of a horizontal metal cylinder with a perforated bottom, through which the grapes are forced by revolving paddles. The stems cannot pass through these openings, and are thrown out at the end of the crush.

D. Pressing the juice from the pulp is the next operation. The press, known as the rack and cloth press or hydraulic press, will give a higher yield and a clearer juice than with the basket press. In the rack and cloth press the crushed fruit is built up in layers in heavy burlap cloths between racks made of wooden slats. Pressure is applied by means of a ram operated by a hydraulic pump.

In basket presses the cloths and racks are not used. The crushed fruit is held in a strongly reinforced wooden basket of cylindrical shape, which rests on the press floor. Pressure is applied by lever and screw in small presses, and by hydraulic pressure in the larger presses.

The crushed fruit may be heated up first in a steam-jacketed kettle, before pressing, if so desired.

E. Pasteurizing fruit juice, used for bulk, is the next operation. Proteins and gums are coagulated, which otherwise would cloud out in the bottle. Grape juice is usually sterilized and stored several months to permit separation of cream of tartar before bottling. A very common and effective pasteurizer consists of a block tin or monel metal coil surrounded by hot water. The juice flows through this pipe and

can be heated to any desired temperature, depending upon the surrounding water. A thermometer at the juice outlet is necessary for temperature control. The temperature of the juice should be around 175° F. when it comes out of the pipe. The hot juice is delivered into containers for settling.

F. Filtering the juice improves the appearance of the product. The simplest filter is the bag filter, which consists of a conical heavy duck or felt bag. The rate and effectiveness of filtration may be increased by the addition of infusorial earth, or asbestos pulp to the juice before filtration. Bag filters commonly hold 10 gallons of juice at each filling.

For large scale production the juice is filtered through an ordinary plate and frame filter press, using infusorial earth as a filter aid. The filter aid and water are mixed together in the kettle and then pumped through the filter. In this way the filter bed is built up. A new type of filter equipment has been introduced. This machine contains a series of round filter plates which are chromium or silver plated. The plates are arranged so that a round sheet of asbestos fits into a pair, which is separated by a special grid, and which permits the filtered juice to flow to the outlet. The juice is pumped through by means of a very small motor. The juice which then goes through this layer of asbestos is crystal clear, but not sterile. When the layer of asbestos becomes clogged, the filtration slows down. The plates must then be removed and the used asbestos replaced with fresh ones. Absolute sterile juice can be had by filtering the product through a bacteria removing filter.

CONCORD GRAPE JUICE AND ITS MANUFACTURE

The Concord grape comes well recommended as the standard for juice manufacture. The Clinton as a rival lacks the foxy flavor of the Concord. The Concord grape is very juicy and the juice has a rich red color. Practically 95% of commercial grape juice is prepared from the Concord grape.

PRESERVATION METHODS

There are a number of methods which may be used to preserve the juice. The following are recommended:

A. Pasteurization of the unfermented juice.

B. Holding juice at a temperature of 28°–30° F. The argols will precipitate out at this low temperature. The juice must be pasteurized, however, when ready to be sold in bottles.

C. Freezing storage is used but slightly. Too much of the tartrates will precipitate out in this method, thus removing some of the desirable ingredients of the juice.
D. Filtering the juice through germ filter presses. A sparkling clear juice is obtained and there is no question that the germs are filtered out.
E. Storage of the juices under a high pressure of carbon dioxide.
F. Concentrating the total solids by evaporation or freezing. The high total solids will prevent further spoilage.
G. Adding to the juice sulphur dioxide or sodium benzoate.

The process of juice manufacture may be divided into six distinct manipulations:

A. Crushing and stemming the fruit.
B. Heating the crushed fruit.
C. Pressing the heated fruit.
D. Sterilizing and bottling juice for storage.
E. Siphoning the juice.
F. Bottling and pasteurizing the trade juice.

CRUSHING AND STEMMING THE FRUIT

The crusher consists of two rollers of metal, usually bronze and revolving at high speed. The rolls are set so as not to crush the stem or seed. The stemmer is a cylindrical revolving drum inside of which are arranged revolving fingers that separate the berries from the stems. The crushed berries and liberated juice pass through the openings in the side of the drum and fall through to the cooker while the stems are picked out of the drum by the fingers.

HEATING THE CRUSHED FRUIT

The liberated juice is run into heating kettles which may be steam jacketed or double boilers or equipment commonly called cookers. The heating temperature should be between 140°–145° F. and heated long enough until the bright purple color is diffused throughout the mass. Heating too long or too high a temperature will result in a harsh bitter taste.

PRESSING THE HEATED FRUIT

The hot grapes are placed on heavy burlap cloths which are on racks and which can be folded over, and built up on top of one another. Any number of presses of various types are available. The hydraulic press is the usual one to use in the factory. The grape solids on the cloth are usually referred to as cheeses. As the number of cloths or cheeses in-

crease there is a flow of juice called the free run juice, since it is the juice which is recovered by the weight of the cheese itself, without additional pressure. The free run juice may amount to 50–55% of the entire quantity of available juice in the fruit. Pressure is gradually applied until all of the juice has drained out of the cheeses.

Cold pressing of the juice is utilized only where light colored juices are wanted and for juice intended for fermentation, making light colored wines.

STERILIZING AND BOTTLING THE JUICE FOR STORAGE

The juice should be strained again to remove coarse particles, and then conducted into the sterilizers. These may be aluminum or steam-jacketed kettles. The juice is heated to destroy all living organisms. The sterilizing temperature ranges from 175°–190° F. The lowest possible temperature without risk of not destroying all living organisms is the best. It is inadvisable, however, to go much lower than 180° F.

The precipitating vessels in which the argols or cream of tartar separates out may be glass carboys or jugs of 5-gallon capacity. They are filled to a few inches from the top with the hot sterile juice. The bottles should be sterilized and warmed up in advance. The necks of the receptacles are sealed with corks of good quality and prepared by dipping into heated paraffin, which closes the pores and canals. The sealed vessels containing the juice are placed in vaults. In about 4 months or more the tartrates, tannins, and solid particles will form a heavy sludge on the bottom. To obtain the best precipitation the temperature should be kept as low as possible, as close to 32° F. as can be maintained without danger of freezing.

SIPHONING THE JUICE

The juice should be siphoned over only during the winter months. The sediment remaining is poured on several thicknesses of burlap stretched on a frame and the juice allowed to drain. This juice should be sterilized and be allowed to precipitate out again. The hot juice when placed in the carboy has a nice red color. As it cools it becomes turbid, and when it clears becomes reddish purple. The hot juice has a harsh taste, whereas the clear juice is pleasant in taste and aroma. As the juice in the carboy cools the cream of tartar separates out, until the solution contains the normal amount of cream of tartar.

BOTTLING AND PASTEURIZING THE TRADE JUICE

The pasteurizing temperature of juice in the bottle ranges from 160°–175° F. If the bottles are filled cold it may take about 10 minutes for

the juice to come up to the temperature, and then pasteurize for about 35 minutes, and cool off in 10 minutes. If filled hot from 25–30 minutes of pasteurizing temperature is sufficient. The heating time will vary, depending upon the size of bottle. Pints and quarts should take around 55 minutes. Large containers should be filled hot before pasteurizing. Bottled juice should be stored in a cool dark place. It should not be stored at lower temperatures than that which was employed to precipitate out the cream of tartar.

REMOVAL OF ARGOLS OR CREAM OF TARTAR FROM GRAPE JUICE

The removal of crude cream of tartar takes place at low temperatures and over an extended period of time. If too much is removed from the juice, it lacks snap, and tartaric acid should be added to make up for it. This method is a long-drawn out process, but there are a number of other methods for hastening this crystallization, some of which are as follows:

A. Freezing the juice and then removing the cold juice from the sludge formed during the freezing.
B. Storing the juice in suitable containers, just above the freezing point of the juice, which is 28° to 30° F.
C. A method patented in 1931 calls for the addition of calcium acid malate, lactate, or acid phosphate to the juice.

APPLE JUICE CIDER

Apples used in the manufacture of cider must be carefully washed and sorted before grinding and pressing. It is very important that all dust or other dirt organisms be thoroughly removed in order to prevent fermentation. The apples should be cleaned in a large container of clean water, stirred around for a while, and then taken out by hand for further inspection. Many modifications may be used, but it is necessary to secure sound, clean fruit for pressing.

When the fruit has been sorted and washed, it can be crushed between two rollers or by grating the apples with a cylindrical grater. The second method is the most efficient.

The pressing out of the juice may be accomplished in several ways. The barrel press is considered the poorest method because the resulting juice is poor and when the necessary force is used the juice spurts out of the filtering cloth. The power presses of the hydraulic type are the most efficient. They have a great capacity, are inexpensive to operate, and a greater yield is obtained from the same amount of fruit as com-

pared with the barrel press. A ton of apples should yield about 175 gallons of juice.

The remaining residue on the filter cloth after juice has been extracted is called pomace. In most cider mills this represents waste. A ton of apples will yield about 700 pounds of wet pomace. This can be pressed again at the end of several hours and the juice added to the first pressing. Another good idea is to moisten the pomace with the juice of the first pressing and then repress. The residual pomace may then be dried and sold for its pectin value for making imitation jellies, or used as cattle feed.

CLARIFICATION OF CIDER

Apple juice is cloudy after extraction, and a common method for cleaning and clarifying it is in heating the juice in order to coagulate the proteins and gums, cooling, and then filtering until clear. Another method consists in taking ½ to 1% by weight of refined infusorial earth with the juice mixing thoroughly and pumping through the filter press. Two or more filtrations may be necessary. Generally, freshly pressed fruit filters with difficulty because the filter becomes clogged with a gummy deposit. By removing a large portion of the colloidal suspension of starches and gums the filtration becomes easier and more rapid. Following are some brief methods for this removal..

Sedimentation

The pressed cider should be stored in clean barrels or tanks for about 10 to 15 hours and the clear juice siphoned off without disturbing the sediment.

Centrifuging

A high-speed centrifuging machine can be used for separating the particles from the cider. Sometimes this machine clogs quickly and a cream separator may be used instead.

Gelatin, Tannin, and Enzymic Treatment

Flash Heating

In this process the juice goes through a series of coils which are steam jacketed. During its passage through, the temperature may go as high as 185° F. The time required for this operation may be about 1 to 3 minutes. A considerable amount of gummy substance is coagulated in this way and makes the juice much easier to filter.

Heating

Fresh cider, when heated to 175° F., forms considerable coagulum. The juice should be kept at 175° F. for at least 10 minutes and then cooled very quickly to room temperature. After allowing to settle, the clear liquid is siphoned over, without disturbing the sediment.

PASTEURIZATION

Apple juice may be pasteurized in a number of ways. Flash pasteurization consists in heating the juice to 185° F. for a few seconds and then cooling quickly, or the juice is kept in the pasteurizer for 20 minutes at about 175° F. Pasteurization may also be done in bottles or other suitable containers. Bottle pasteurizers may be home-made wooden troughs fitted with steam coils, or a live steam pipe, or the bottles may be placed in basket conveyers which carry the bottles through water baths increasing in temperature until they are pasteurized and finally through cold water baths until they are properly cooled. The temperature recommended is 175° F. for 20 minutes. Yeast cells are destroyed at 140° F. to 150° F. for a few minutes. Yeast spores are more resistant and require a higher temperature of 175° F. for 20 minutes. Juices having higher acidity need be pasteurized only to 160° F. to 165° F. Regardless of what method is used to pasteurize the product, it is necessary to cool promptly in order to avoid a cooked taste. The sterilization of bottles and caps before filling will greatly reduce loss from fermentation and mold growth.

CHEMICAL METHODS OF PRESERVING

Sodium Benzoate may be used to preserve cider. The amount necessary to use is 1¼ ounces to 10 gallons of cider. This chemical is more toxic to yeast than to molds. Maximum toxicity is obtained with higher percentage of acid. The amount of this preservative must be declared on the label, as for instance, "Contains $\frac{1}{10}$ of 1% of Sodium Benzoate."

Sulphurous Acid is more toxic to molds than to yeasts. By the addition of .10% of sulphurous acid (20 grams of 5% solution of sulphurous acid per liter of cider) to cider, it may keep for a year if stored at a temperature of about 60° F. The Federal Government will tolerate .0350% of sulphur dioxide in the product offered for sale. This must absolutely be declared on the label, as some states do not allow its use at all.

Carbon Dioxide has also been used to preserve fruit juices. In one process the cider is placed in a specially constructed iron keg, the air is exhausted, thus making a vacuum. The cider is then carbonated at a pressure above 60 pounds per square inch. The cider in the keg is again exhausted of its carbon dioxide, a vacuum is once more created, and then carbon dioxide pumped in a second time. It is claimed that this method destroys the microorganisms which cause spoilage.

RED RASPBERRY JUICE

This juice possesses a very pleasing flavor and is made in almost the same manner as grape juice. Cuthbert, Miller, and Brandywine varieties are used.

The juice yields are high, averaging from 70% to 85% of the fruit, obtained by crushing and pressing the berries. It is necessary to press slowly and to use double cloths. The juice should settle clear, preferably without filter aids. Pasteurization at 175° F. in bottles is a satisfactory method for preservation.

BLACK RASPBERRY JUICE

Upon being pressed without previous heating, yields of 60% to 75% of juice were obtained. Pressure must be applied very gradually for good yield. The juice is not noticeably injured in flavor or color by pasteurization. The berries may also be pressed after heating. The sterilized juice is rather acid and requires the addition of sugar to make it palatable.

STRAWBERRY JUICE

Best results are secured by grinding the fruit first, and then applying pressure very gradually. The yields range from 60% to 85%. The juice can be sterilized without injuring the color, but there is generally marked injury to the flavor. Color and flavor change rapidly when kept in storage, the bright red color changing to a dull brownish-red tone. Disagreeable flavor also develops upon standing in storage.

RED CURRANT JUICE

Without previous heating juice yields vary from 65% to 70%. When pressed with heat the yield is generally about 73% to 80%. There is a slight loss in flavor when heated, but not in color. The sterilized juice will keep well in cold storage at from 32° to 35° F. The juice is best prepared by cooking until soft and then pressing. The juice is then freed from sediment and sterilized in glass.

BLACK CURRANT JUICE

It is necessary to heat the fruit before pressing to secure a satisfactory yield and quality of juice. The yield of heat-pressed juice ranges from 68% to 78%. The flavor and color keep well after sterilization, even for a long period of time.

BLACKBERRY JUICE

Cooking before pressing increases the yield, aroma, and flavor of the fruit. It is necessary to apply the pressure gradually in order to avoid the pulp from passing through the cloths. Yields, cold pressed, range from 67% to 70%; hot pressed, from 75% to 80%. There is very little loss of flavor or color in sterilization.

LOGANBERRY JUICE

This juice has become very popular. It has deep red color, very rich flavor, and high acidity. Thoroughly ripe fruit gives the best juice, while under-ripe berries are light in color, excessively tart and astringent in taste. The juice is best extracted by heating the berries in the kettle to about 150° F. and then pressing on the hydraulic press. The juice should then be cooled and filtered through a felt bag, subsequently through cotton pulp filter. This juice is rich in pectins and gums, and difficulties may be encountered in filtering the same. In bottles the juice is pasteurized at 175° F. for 40 minutes.

The filtered loganberry juice may be bottled undiluted and unsweetened, diluted and sweetened, or sweetened but undiluted. Sugar helps to retain the fresh berry flavor and to prevent the development of a bitter astringent taste.

CHERRY JUICE

This juice is of recent introduction. The English Morello, and Montmorency cherries from New York, Michigan and other states are the varieties used.

Without previous heating, the yield after pressing ranged from 70% to 80%. The fruit is washed and ground to a course pulp and then pressed. The juice is heated rapidly to 190° to 200° F. and cooled. The juice will be cloudy and must be clarified before bottling. The distinctive color and flavor are well retained after sterilization. Juice pressed containing the kernels was slightly better than juice without the crushed kernels, because it possessed flavor derived from the kernels.

PINEAPPLE JUICE

The pineapple used for this purpose should be field ripened. The fruit is first peeled and then cored. It is then shredded and pressed, the resulting juice is strained and then heated to 170° F. in stainless steel jacketed kettles, filled at once into plain cans, and held for 20 minutes before cooling. In some factories, the warm juice is poured into cans which are then closed under vacuum. The canned juice is then sterilized in

tanks of hot water for 30 minutes at 180° F. In other cases the juice is flash pasteurized, poured into cans, and closed under vacuum. Heating the juice causes a slight change in flavor. Keeping the juice in cold storage at 32° to 35° F. after sterilization will help to retain a distinctive, satisfactory, pineapple flavor.

ORANGE JUICE

In spite of excessive study of orange juice, a successful method for retaining the fresh orange flavor has not yet been realized. Sterilizing the juice injures the flavor, which gradually deteriorates when the juice is kept at ordinary temperatures. In cold storage, the flavor is well retained.

The two methods for making the juice involve the pressing of peeled oranges in screw presses or pressing the orange halves down a rapidly revolving burr. Removing the peels before pressing results in a juice deficient in orange flavor. With the burr method, more of the oil goes into the juice and it therefore has a better flavor.

The Valencia oranges yield a juice which is far better than Navel oranges. The juice from both undergoes a distinct but slight change in flavor when sterilized at 80° C. If kept at 32° to 35° F. no flavor change occurs for a few months. At ordinary temperature the change in flavor is rapid, accompanied by darkening of color. It has been found that by keeping the air from contact with the surface of the orange juice the color and flavor changes are not so pronounced. Orange juice must be frozen quickly and deaerated, or removing the dissolved air from the juice previous to freezing. This may be done by treating with a high vacuum in a closed tank or by allowing it to flow over a surface while exposed to a high vacuum.

In canning the juice, it is first screened, deaerated, and then flash pasteurized quickly for 5 seconds at 205° F., and then quickly cooled to 180°–190° F., and immediately poured into cans which are closed under 12 to 14 inches of vacuum and cooled. Carbonating and sterilizing the juice in carbon dioxide permits satisfactory flavor and color retention.

LEMON JUICE

This juice is prepared by cutting each lemon into two or more pieces, placing the fruit in cloths between racks and pressing it. The yield ranges from 35% to 40%.

A large proportion of oil is included, but is removed by passing the juice through a separator, which at the same time removes some of the suspended material.

The juice can be sterilized by heating at 70° C. for 30 minutes. There

is very little loss of flavor. When kept at a low temperature, it retains its rich lemon flavor for many weeks, and if frozen quickly it will keep for a long time. Eventually, however, a peculiar flavor similar to a lime flavor seems to develop. The exclusion of all air in this juice is important, but even this exclusion was not successful in controlling the change of flavor.

PRUNE JUICE MANUFACTURE

Prune juice is made by extracting dried prunes with water until practically all of the soluble substances have been removed. The prunes are washed clean and then soaked in hot water for 1 to 4 hours at 200° F. The soaking time depends upon the body and toughness of the prune. The liquid from the first soaking is used to extract the soluble material from a second, and finally from a third lot of an equal amount of prunes. In the meantime the first lot of prunes is extracted a second, third, or even a fourth time, for an hour each time, and at 200° F. All of the extractions are then combined. Each lot of prunes may be extracted 4 to 5 times. Fifty pounds of prunes should approximately yield 15 gallons of juice, with about 18% solids. The juice may be filtered through several layers of cheese cloth or through a pulp filter. The concentration of the juice may be controlled by boiling or dilution with water. Prune juice in bottles, quart size, should be pasteurized at 190° F. for 35 minutes.

GRAPEFRUIT JUICE

The fruit is washed and cut into halves or quarters. Do not shred the fruit, for the more the juice comes in contact with the peel, the more bitter will the flavor of the finished product be. The fruit is pressed gradually, and the yield generally ranges from 70 to 100 gallons of juice from a ton of grapefruit. The juice is strained through copper or bronze gauze, and then given a preliminary pasteurization at 170° to 185° F. Best results are obtained by flash pasteurization, thus avoiding any chances of overheating. When ready for bottling or canning, the juice can be clarified by the addition of kieselguhr and then filtering. If the juice exceeds 1% in acidity, a slight addition of sugar will improve the taste. For final bottling or canning the juice is heated once more, filled into the containers, and sterilized at 170° to 185° F. for 30 minutes.

CONCENTRATED FRUIT JUICES

Fruit juices can be concentrated in a number of ways, but concentrating in vacuo is the most desirable. Concentrating in open kettles results in loss of flavor and color. Concentrating by the spray process

has been used successfully for making powdered lemon or orange juice. Spray-drying of grape juice has been accomplished with some degree of success. Concentrating by freezing preserves the aroma and color of the fruit. The fruit juice is then separated from the ice crystals.

Sweetened juice applies to fruit juice to which has been added 50% or less cane sugar.

Fruit syrup is the name applied to fruit juices to which has been added 50% or more of cane sugar, and must contain at least 33⅓% of pure fruit juice.

Fruit juice concentrate is the name applied to fruit juices which have been concentrated by evaporation of the excess water in a vacuum or under atmospheric pressure or by freezing and the subsequent separation of the ice and concentrated juice. Most apple concentrates made by evaporation in the open kettle possess a cooked taste.

ORANGE FRUIT CONCENTRATE

Orange Juice Concentrate, 72° Brix	1	gal.
Sugar Syrup, 60° Brix	5	gal.
Orange Oil, California Cold Pressed	¼	oz.

One and one-half ounces of this syrup is added to a 6½-ounce bottle and carbonated, or added to an equivalent amount of cold water.

LEMON FRUIT CONCENTRATE

Lemon Juice Concentrate, 72° Brix	1	gal.
Sugar Syrup, 60° Brix	20	gal.
Lemon Oil, California Cold Pressed	¾	oz.

Use this syrup in the same manner as above.

THE CLARIFICATION OF FRUIT JUICES BY ENZYMES

Fruit juice when first pressed contains finely suspended matter. Some of it may settle out on standing, much of it can be removed by filtration or by centrifuging. It sometimes requires several such treatments to completely remove the colloidal material, which is the real cause of cloudiness. These treatments are expensive and time consuming. By destroying the colloids chemically, fruit juices can be quickly clarified.

The abundant colloidal material in fruit juice is pectin, small amounts of protein, tannin, and starch. By adding the enzyme pectinase to fruit juices containing pectin, hydrolysis of the pectin takes place, and by adding the enzyme diastase, the starches are converted into soluble sugars.

The enzyme pectinase is the most efficient at a *p*H of 3. The rate of enzyme action or breaking down of the pectin into soluble forms de-

pends upon (1) time of reaction, (2) temperature of juice, (3) pH, and (4) quantity of enzyme used. In the case of cloudy cider, the enzymes may be added to the juice as soon as pressed. If the temperature of the tank is maintained around 70° F., enzymotic action and clarification can be accomplished overnight. At lower temperatures it may take as long as 48 hours for complete hydrolysis of the pectins. At higher temperatures, around 110° F. to 135° F., enzymotization is complete in several hours. If there is no appreciable loss of color or flavor, this method of clarification is satisfactory.

Some juices naturally clarify quicker than others, with the aid of enzymes. Different varieties of grape and apple juice require separate methods of enzymotic clarification. Strawberry juice clarifies easily, cherry juice with difficulty. Currant juice contains considerable pectin and more precipitate is formed than in other juices, but still it filters easily after clarification. It is difficult to set up a fixed formula for the enzymotic clarification of juices. The following methods, however, give some idea of how to treat pectin syrups and fruit juices.

USING CLARASE* FOR CLARIFYING PECTIN JUICE AND FRUIT JUICES

1. Preparatory to enzyme treatment for clarification purposes, THOROUGH INITIAL cooking of the pomace or the fruit is a necessary prerequisite, as the starch must be thoroughly gelatinized before enzyming in order to produce a subsequently starch-free product. Following the pressing operation, the pectin liquor or fruit juice should be cooled to between 77° F. and 86° F.

2. Settling the juice before enzyme treatment would be a decided advantage, as this permits much of the suspended solids to settle out. The use of a preservative, such as SO_2, during settling has no harmful effect on CLARASE during the subsequent digestion.

3. For treating average pectin juice, one pound of CLARASE will be sufficient to clear the starches from between 10,000 and 15,000 pounds of thoroughly cooked juice, at a temperature of from 77° F. to 86° F. in an hour or less.

For the treatment of apple juice, quince juice, or crab apple juice, 1 pound of CLARASE will be sufficient for between 6,000 and 8,000 pounds, under the same conditions.

4. For the amount of juice to be treated, calculate the quantity of CLARASE required. Weigh out the CLARASE in dry form and proceed to dissolve it in water of about 80° F. Pour just a little water at first

* Clarase is supplied by Takamine Laboratory, Inc., Clifton, N. J.

on top of the dry CLARASE and stir into a paste. Add a little more water until the CLARASE is thoroughly wet but still in the form of a thick paste, after which more water can be added and within a short time the material will all pass into solution.

5. Pour this CLARASE solution into the pectin or fruit juice to be treated, which at this point must have been cooled to between 77° F. and 86° F., and stir thoroughly throughout the pectin or fruit juice. Digest until the iodine test shows a red or reddish-brown color. Traces of blue indicate undigested starch and digestion should be continued until complete conversion is accomplished; or otherwise more CLARASE may be required for the particular fruit juice being treated. It is customary to make preliminary laboratory tests on a small scale for each batch of juice before digesting on a large scale. Such preliminary trials will indicate the exact amount of enzyme required in each instance and the time required for the digestion.

6. After a red or reddish-brown color is obtained, the pectin or fruit juice is ready for final filtration and should be heated to about 125° F. or over to stop the enzyme action; and higher still if desired to filter at once. Filtration must be conducted by a filter capable of removing fine colloidal particles. The most thorough digestion possible to obtain will be nullified completely by the use of INADEQUATE filter-equipment; while with a PROPER filter, the juice is brilliant and sparkling clear.

7. Pectin liquor so filtered is then ready for concentration, pasteurizing, or bottling. Fruit juices so treated are ready for making up into jelly. They are free from starch and other suspended matter and will produce brilliant jellies which will maintain their clarity indefinitely.

USING PROTOZYME PX* FOR CLARIFYING PECTIN JUICE AND FRUIT JUICES

The following method is recommended for the removal of starch and protein from pectic solutions:

QUANTITY USED: .1% of Protozyme on a basis of weight, or approximately 4½ to 5 pounds of Protozyme to 500 gallons of juice. This quantity may be increased or decreased to suit individual requirements, condition of the juice, and time allowable for the reactions. About an hour to an hour and a half before the batch is ready for treatment, weigh the required amount of Protozyme into a suitable container. Add water (½ gallon to every pound of enzyme used). Allow the mixture to stand at least an hour, stirring occasionally. Squeeze through cheese cloth, using only the liquid thus obtained.

* Jacques Wolf and Co., Manufacturers of Protozyme PX, Passaic, N. J.

NOTE: In treating pectic solutions it will not be necessary to strain off the solid matter if you conclude your operation with a final filtration of the pectic liquor prior to concentrating. However, it is advisable in any case to make a solution of the Protozyme with water to facilitate the enzyme going into solution more rapidly.

When all the juice from each batch has been accumulated, adjust the temperature to 120° F. Then add the enzyme liquid to the juice; if convenient, agitate for two or three minutes. Stop the agitation and do not disturb the liquor in any way until the desired reactions are completed. It will not be necessary to apply any heat to the liquor during the treatment as the reactions will be completed before the temperature takes a material drop.

TIME OF ACTION: The reactions should be complete in 40 to 60 minutes. The end point of the starch reaction is indicated by the appearance of a reddish brown color when a small amount of dilute iodine solution is added to a sample of the juice. Previous to the removal of the last trace of starch, samples will show the characteristic blue color when treated with the iodine solution.

After the desired reactions have been obtained, raise the temperature of the batch to 170° F. rapidly, maintaining this temperature for 10 minutes. The acting powers of the enzymes are then destroyed, after which the liquid can be allowed to settle in the tanks, or if you conclude your operations with a final filtration, the batch can be filtered at once.

NOTE: If acid is used in the extracting water, the temperature of the liquor must be adjusted to 90° F. before adding the enzyme. The destructive temperature can also be lowered to 125° F. when acid is used. Optimum *p*H is 3.4–3.8 at 120° F. However, if the *p*H is adjusted to 3.2 to 2.9, the temperature for the reactions must be lowered to 90° F.

PECTINOL A* (SOLUBLE) FOR CLARIFYING APPLE CIDER

Enzyme Clarification of Cider Is Covered by U. S. Patent 1,932,833

DIRECTIONS FOR USE: Add Pectinol A (Soluble) to the cider to be clarified as quickly after pressing as possible. Use the proportion of one pound of Pectinol A (Soluble) per hundred gallons of cider (maximum). Allow to stand 5 to 6 hours at room temperature, or, better, overnight if possible. Any convenient receptacle such as a barrel, vat or tank is suitable, depending on the amount of juice to be clarified.

Pectinol A (Soluble) goes readily into solution when sifted directly into the juice with gentle stirring.

*** Röhm & Haas Co., Philadelphia, Pa. (Manufacturers).**

To produce a polished, sparkling juice, filter in the usual manner after clarification is complete.

Pectinol A (Soluble) is not a preservative. If the juice is to be bottled for later sale, it should be preserved by pasteurization. Heating to 170° F. in the bottle and holding for 20 minutes is recommended.

FRUIT JUICE AND APPROXIMATE SOLIDS

Fruit juice used in jelly making should contain not less than the approximate percentage of total solids shown below.

The total solids is determined by immersing a Brix hydrometer into a cylinder filled with the juice at room temperature.

Juice	Brix or Per Cent Solids
Apple	12 –13
Blackberry	8 – 9
Blueberry	14
Cherries (Sweet)	17 –20
Cherries (Sour)	15 –17
Crab Apple	13 –15
Currants (Red)	10 –11
Currants (Black)	13 –15
Grapefruit	10 –12
Grape	14 –23
Lemon	11 –12
Lime	9 –11
Loganberry	11 –12
Orange	12 –15
Peach	13 –14
Pineapple	13 –14
Plum	10 –12
Quince	12 –13
Raspberry (Black)	11 –13
Raspberry (Red)	9 –11
Strawberry	5½– 7

CHAPTER XII

CANNED FRUITS AND VEGETABLES, CANNING, DRIED FRUITS AND VEGETABLES, SULFURING FRUITS

CANNED GOODS

Canned goods are commonly packed in 5 sizes of cans, the commercial designation and average net contents of which are:

No. 1	12 oz.
No. 2	1 lb. 4 oz.
No. 2½	1 lb. 13 oz.
No. 3	2 lb. 3 oz.
No. 10	6 lb. 9 oz.

CALIFORNIA CANNED FRUIT GRADES

Adopted by Canners League of California

GENERAL DESCRIPTION OF GRADES

SUPERLATIVE QUALITY—The top grade to be designated "Fancy" and packed in extra heavy syrup.

FINE QUALITY—The grade between the top and the Standard Grade to be designated "Choice" and packed in heavy syrup.

GOOD QUALITY—The medium grade to be designated "Standard" and packed in medium syrup.

SECOND QUALITY—Fruit packed: In 10% syrup to be designated "Second." In Water to be designated "Water." For Bakery Use to be designated "Pie" and "Solid Pack Pie."

HEAVY SYRUPS to be used on Apricots, Peaches and Plums, and, beginning with 10% sugar by weight on Seconds, to increase in steps of 15% to each grade.

LIGHT SYRUPS to be used on Pears, Cherries and Grapes, and, beginning with 10% sugar by weight on Seconds, to increase in steps of 10% to each grade.

EITHER THE BRIX or Balling Scale is used on hydrometers or saccharometers to indicate the percentage by weight of sugar going into the

solution, the terms "percentage" and "degree" being synonymous when using these instruments.

It is to be understood in connection with the systems of nomenclature herein adopted that the grades of the different varieties of fruits are to follow, as closely as is *practicable*, these general specifications together with the detailed specifications for each grade and variety; and it is to be understood that the words or expressions descriptive of grade are used in the following definitions with the significance which they generally carry among the American canned foods trade. Also, while goods for any grade must not go below the qualifications fixed for such grade, nevertheless, in comparing a delivery of the pack of one season with a delivery of the pack of another season, it must be borne in mind that a great variation in the quality of the raw material one season as compared with another is possible and such variation will necessarily be reflected in the quality of the pack of each grade of the varieties affected, one season as compared with another.

The same specifications as to quality of grade apply to all sizes of cans.

Unless otherwise specified, fruit listed below are understood to mean:

Apricots—Approximate halves, unpeeled fruit.
Pears and Peaches—Approximate halves, peeled fruit.
Cherries, Plums, Grapes—Whole unpeeled fruit.

MAXIMUM NUMBER OF PIECES PER CAN

APRICOTS	3" 8 oz.	3¼" 8 oz.	Picnic	No. 1 Tall	No. 2	No. 2½	No. 10
Fancy	9	10	12	16	19	24	86
Choice	11	12	15	20	24	30	108
Standard	13	15	18	26	31	42	151
*PEARS AND PEACHES							
Fancy	4	5	6	8	9	12	43
Choice	5	6	7	10	12	15	54
Standard	7	7	9	13	15	21	76
ROYAL ANNE CHERRIES							
Fancy	31	33	41	57	67	85	306
Choice	38	41	51	71	83	105	378
Standard	46	50	62	89	106	145	522
FIGS							
Fancy	9	10	11	17	21	30	110
Choice	11	12	14	21	26	38	140

* Pears and Peaches in the "8-oz." Cans (3 inch and 3¼ inch) not otherwise specified may be either halves or quarters.

MINIMUM NUMBER OF PIECES PER CAN

All Grades

	3" 8 oz.	3¼" 8 oz.	Picnic	No. 1 Tall	No. 2	No. 2½	No. 10
Apricots				(No minimum)			
Pears and Peaches	3	3	3	4	4	6	18
Royal Anne Cherries				(No minimum)			
Figs	3	3	4	7	8	12	40

MAXIMUM VARIATION IN THE NUMBER OF PIECES PER CAN

No lot or parcel shall vary more than the following:

APRICOTS	3" 8 oz.	3¼" 8 oz.	Picnic	No. 1 Tall	No. 2	No. 2½	No. 10
Fancy	3	3	3	4	5	6	21
Choice	3	3	3	5	6	7	25
Standard	4	4	4	6	7	8	29
PEARS AND PEACHES							
Fancy	2	2	2	3	3	4	14
Choice	2	2	2	3	4	5	18
Standard	3	3	3	4	5	6	22
ROYAL ANNE CHERRIES							
Fancy	6	6	8	12	14	16	58
Choice	8	8	10	15	17	20	72
Standard	16	16	20	30	35	40	144
FIGS							
Fancy	3	3	3	5	6	7	25
Choice	4	4	4	6	7	8	29

Unless otherwise specified, the maximum variation in the number of pieces per can, with the exception of cherries and grapes, shall in no case exceed 25% of the high count in any can in any lot or parcel; that is, the low count shall not be more than 25% below the high count in a particular parcel. In the case of cherries and grapes the maximum percentage, unless otherwise specified, shall in no case exceed 20%. The number of units specified as the minimum of a range shall be the integer nearest to the exact quantity. For example, if the maximum count be 10 halves, the minimum will be 7; if the maximum count be 13 halves, the minimum will be 10. The above counts may be shown on the label as: Approx. 7 to 10 Halves and Approx. 10 to 13 Halves.

YELLOW CLING PEACHES

FANCY—In Syrup, 55% Sugar When Packed.—Fruit to be of very high color, ripe yet not mushy, and free from blemishes serious for the grade, halves uniform in size and very symmetrical.

CHOICE—In Syrup, 40% Sugar When Packed.—Fruit to be of high

color, ripe yet not mushy, and free from blemishes serious for the grade, halves uniform in size and symmetrical.

STANDARD—In Syrup, 25% Sugar When Packed.—Fruit to be of reasonably good color and reasonably free from blemishes serious for the grade, halves reasonably uniform in size, color, and degree of ripeness, and reasonably symmetrical.

SECONDS—In Syrup, 10% Sugar When Packed.—Trade designation "Seconds." Fruit to be tolerably free from blemishes serious for the grade, halves tolerably uniform in size, color, and degree of ripeness.

Packed in Water.—Trade designations "Water." Fruit to be tolerably free from blemishes serious for the grade, halves tolerably uniform in size, color, and degree of ripeness.

Packed for Bakery Use.—Wholesome fruit unsuited for above grades. Trade designation "Pie": Minimum drained weight 76 ounces. Trade designation "Solid Pack Pie": Minimum drained weight 92 ounces.

FIGS

FANCY—In Syrup, 55% Sugar When Packed, to Cut Out a Minimum of 32%. Fruit to be of very fine color, ripe yet not mushy, free from blemishes serious for the grade, and uniform in size; woody stems removed.

CHOICE—In Syrup, 45% Sugar When Packed, to Cut Out a Minimum of 27%.—Fruit to be of fine color, ripe yet not mushy, free from blemishes serious for the grade, and uniform in size; woody stems removed.

SPLIT FIGS—Quoted as Fancy or Choice, to conform to the Fancy or Choice specifications except for the fact that the figs are split.

SECONDS—Figs that do not conform to the foregoing specifications.

PREPARED PRUNES IN SYRUP

Prepared Prunes in syrup to be properly matured, clean, sound fruit, dried in accordance with the usual commercial practice; to be whole, separate, and of good color, odor and flavor. The count, after packing and after draining in the standard manner, not to vary in any one parcel in excess of 10 to the pound; thus, for example, the count in any one parcel to be within a range of 20 to 30, 30 to 40, 40 to 50, etc. Cans to be well filled with fruit and packed with sugar syrup testing not less than 20% sugar when packed. The minimum drained weights thirty days after packing to be as follows:

3″ "Eight Ounce"	6¼ Ounces
3¼″ "Eight Ounce"	6¾ Ounces
Picnic	8 Ounces
No. 1 Tall	12 Ounces
No. 2	15 Ounces
No. 2½	22 Ounces
No. 10	79 Ounces

At time of packing the weight usually runs 4% to 5% less than the above and increases gradually for thirty days or longer.

CANNED FRUITS

CHERRY

About 250 varieties of cherries are grown.

OXHEARTS (black and white) TARTARIAN BIGERAN	Are best for eating
MORELLO MONTMORENCY EARLY RICHMOND	Are cooking cherries (for pies, puddings)

ROYAL ANNE cherries are considered the best canned cherries.

APRICOTS

Closely related to the peach, and originally came from Armenia. They are grown extensively in Japan and China, and also in California. The kernel is used in making "Kernel Paste," a substitute for almond paste.

Grades	PARK	A fleshy fruit
	BLENHEIM	High in color

Apricots are sold in canned form and as dried fruit. The so-called Spanish apricot has a higher acidity than the domestic and the latter is therefore preferred in preparations where an excess of acid would be harmful (See Apritop).

PEARS

Although a great many different pears are grown in America and Europe, the BARTLETT and KIEFFER varieties are commonly found in the canning industry.

PEACHES

Originally grown in China, are now cultivated in Europe, Africa, Asia, and also in America. In general there are two kinds of peaches

FREE, in which the pulp separates readily from the stone, and

CLINGS, in which the pulp adheres strongly to the stone.

Peaches are dried and canned. The canned peaches are packed under the following trade designations:

YELLOW CLING PEACHES	Fine appearance and color
SLICED YELLOW CLING PEACHES	
YELLOW FREE PEACHES	Inferior in appearance but of peculiar, much preferred flavor

The dried peaches are of the yellow free variety.

NECTARINE

A variety of the peach. Smaller in size and with a smooth skin.

MUSCAT GRAPES

A very sweet, spicy-tasting grape.

PLUMS

The plum is a native of Asia, brought to Europe 100 years ago, and shortly after to America.

Varieties	The Cherry plum in Europe
	The Japanese plum
	The Chinese plum
	The Wild Goose plum in America
	The Sand plum in America
	The Damsons in England
	The Green Gage in England
	The Mirabelles in England

FRUITS FOR CANNED FRUIT SALADS

APRICOTS	Halves
BARTLETT PEARS	Halves or quarters
YELLOW CLING PEACHES	Halves, quarters, sixths, or eighths
PINEAPPLE	Sectors
MARASCHINO TYPE CHERRIES	White, pitted, colored red with U. S. food colors

APPLES

The tins shall be well filled with ripe, firm winter apples in water.

APPLE BUTTER

Apple butter shall be made from whole, sound, fresh, ripe fruit, with no cores, peelings, or stems, free from preservatives and glucose. The finished product shall contain not less than 55% of solids.

A. CANNED SOUPS

1. Consomme
   A clear soup, made from beef broth and a combination of the juices of several vegetables, usually those of carrots, turnips, onions, leeks, and parsley.
2. Chicken Gumbo
   A soup made from chicken and tomato stock, to which is added chicken meat, rice, and okra (gumbo). The latter gives the soup its peculiar flavor.
3. Julienne
   A soup made from beef broth, small peas, shredded carrots, turnips, celery, leeks, and cabbages. A medium thick soup.
4. Mock Turtle
   A dark colored, rich, thick soup. Made from tomato and meat juice, thickened with flour, and flavored with spices and herbs.
5. Tomato Soups

Tomato Bouillon	Made from tomato juice and beef broth.
Tomato Soup	Cooked down tomato juice, flavored with salt, sugar and spices. Thickened with flour.
Tomato Cream Soup	Made from tomato juice and added cream.

6. Mulligatawny
   Meaning "pepper water." A hot and spicy soup, made from chicken stock and ground tomatoes, flavored with curry powder.

B. CANNED VEGETABLES

BEANS

State Beans	Pea bean.
California Navy Beans	In "small" and "large" size.
Michigan Navy Beans	An easy and quick-cooking bean.

Kintoki Beans	From China and Japan; used principally in chili con carne.
Pinto Beans	A freely speckled bean. Very tender.

Beans are put up in four different ways:

Beans with Plain Sauce	Molasses, sugar, salt, water.
Beans with Tomato Sauce	Molasses, sugar, salt, tomato pulp, spices.
Beans with Pork and Plain Sauce	Slices of pork and plain sauce.
Beans with Pork and Tomato Sauce	Slices of pork and tomato sauce.

STRING BEANS

There are two different kinds of string beans.

The flat pod bean and
The round or refugee bean.

Both can be wax or green beans.

No. 2 can shall contain not less than 13 ounces after draining.

No. 10 can shall contain not less than 4 pounds after draining.

BEAN SPROUTS

These are sprouted beans of the MUNG variety, a bean indigenous to China, but now also grown in the United States. It is a small, round bean.

"Bean sprouts" are used in chop suey and other Chinese food preparations.

LIMA BEANS

Lima beans, if canned, shall be medium sized, fresh green or white limas, free from undeveloped, overripe, or hard beans.

No. 2 tins shall contain not less than 13 ounces after draining.

No. 10 tins shall contain not less than 4 pounds after draining.

PEAS

There are two kinds of peas:

1. The early June peas, which mature in June. They are round, of smooth skin, and are the more expensive kind.
2. The sweet peas, which mature in July. They are irregular in shape, mostly oblong, and have a wrinkled skin.

The peas themselves are distinguished by their size. According to the mesh of the screen through which they pass, they are classified as:

No. 1; No. 2; No. 3; No. 4; No. 5; No. 6

Peas are put up in a brine consisting of water, sugar, and salt.

A No. 2 can shall contain not less than 12 ounces of peas after draining.

A No. 10 can shall contain not less than 4 pounds 8 ounces of peas after draining.

"Alaska" and "Winner" peas are trade names for early June peas, not indicating their origin.

ASPARAGUS

There are three kinds of asparagus:

The white asparagus—the spear is kept under the ground.

The green asparagus—the spear grows above the ground.

The peeled asparagus—the spear is freed from its skin.

There shall be about 40 stalks per No. 2½ can.

CARROTS

Carrots are put up in cubes with a brine like peas, and together with peas under the name of Carrots and Peas.

OKRA

Okra is the young pod of the okra or gumbo plant.

The pods have from five to twelve sides and are from two to ten inches long. They contain numerous small seeds.

Okra is used principally in gumbo soup.

DRIED BEANS

Black Lima	Ceci
Black Eye	Fava (a large bean)
Black Turtle	Lima

Grades: Extra Choice, Recleaned, Choice Recleaned, Sample.

Marrow	Roman
Pea	Soya
Red Kidney	Yellow Eye

TOMATOES

Canned tomatoes must be clean, sound, ripe, fairly evenly colored, well-peeled, and cored. The can, upon being opened and drained over a sieve of ¼-inch mesh for 2 minutes, shall show not less than 50% of the contents above the screen.

TOMATO PUREE

May be made from either strained tomatoes * or trimming stock,** but when made from the latter the label must carry an explanatory legend equivalent to "Made from trimmings."

The customary requirements for tomato puree are:

Specific Gravity for Fancy Goods 1.045
Specific Gravity for Heavy Goods 1.050

SUCCOTASH

Succotash is a mixture of 75% corn and 25% lima beans.

CORN

Canned corn must be well cleaned and must be free from silk, bits of cob, and other foreign material. It should be of New York, Maryland or Indiana grading.

A brine consisting of salt, sugar, and water is added.

"SHOE-PEG" Corn, is corn on the cob minus the cob.

No. 2 tins shall contain not less than 13.5 ounces of corn after draining.

No. 10 tins shall contain not less than 4 pounds 8 ounces after draining.

SPINACH

Canned spinach must be solid-packed, from fresh green stock, and must be free from grit No. 3 shall contain not less than 1 pound, 9.5 ounces after draining the tin for 2 minutes over a 1/8-inch mesh screen.

PIMENTOS

Pimentos are large, sweet, red peppers that have been peeled and put up in their own juice.

DRIED FRUITS

APRICOTS

See under Canned Fruits.

CITRON

The citron grows on a tree, similar to the orange or lemon tree, which is cultivated in China, Persia, Greece, Palestine, Italy and California.

* Strained tomatoes. Obtained by straining sound, ripe tomatoes, either raw or cooked, through a screen that removes skins and seeds.

** Obtained by straining sound peeling, pieces and trimmings from ripe tomatoes through a screen that removes skins and seeds.

The fruit is an oblong, 5–9 inches long, resembling a lemon, but with a very thick peel and a smaller amount of acid pulp. The peel, thick and spongy, is used in the preparation of candied or preserved citron, and is also used in the dried state as citron peel. The drained citron peel is sugared, but is not coated with sugar, as the candied kind is.

DATES

Mesopotamia produces about 80% of the world supply of dates, the fruit of the date palm, which grows in bunches of 20 pounds and more. The palm is cultivated in western Asia, northern Africa, southern California and Arizona. Dates contain about 55% of sugar and 7% of protein; they are of high nutritive value.

Varieties

Hallawi Date	From Persia. Firm in texture, bright golden in color.
Khadrawi Date	Also from Persia. Less firm in texture, dark in color.

Both varieties are alike in flavor.

Fard Date	A dark colored, firm Arabian date.

FIGS

The fig is largely cultivated in the Mediterranean countries. It looks like a pear when fresh and is harvested in June and again later in fall. Only the fruit of the second harvest can be dried and shipped.

VARIETIES

Smyrna Figs	Large, sweet, white fruits. Shipped in small cases, boxes, or baskets, pressed flat. They are considered the best variety.
Adriatic Figs	Shipped from Greece, squeezed together and placed on strings.
Calimyrna Figs	Grown in California from stock brought from Smyrna, Turkey.
Istrian Figs	Small, very sweet. Do not keep well. Shipped mostly in barrels or cases.
Mission Black	A black fig, cultivated in the Southern States.

PRUNES

Prunes are dried plums. (See under Canned Fruit.)

California, Oregon and Italy take the foremost place in producing prunes.

There are three ways of curing prunes:

I. Sun-dried.
II. Curing in evaporators.
III. Partially cooking and then drying either by method I or II.

VARIETIES

California or French Prunes	Very sweet
Oregon or Italian Prunes	Tart
Oregon Petites	Sweeter than Oregon

Prunes are graded into ten sizes:

20– 30s
30– 40s
40– 50s
50– 60s
60– 70s
70– 80s
80– 90s
90–100s
100–110s
110–120s

RAISINS

Raisins are dried grapes.

There are several special grapes, which are best adapted for making raisins:

I. The muscatels or sun-dried raisins. From Malago and Valencia.
II. The Valencias or dipped raisins. Dipped in potash lye, containing lavender and rosemary, and in olive oil.
From Valencia, called Denis.
From Turkey, called Smyrna.
From California, called Valencias.
III. The Sultana, the small, tart, seedless raisins from Turkey, Greece, and Persia.
IV. The Thompson raisin, a true seedless, very sweet raisin from California.
V. The Puffed Raisin, seedless raisins, not sticky.

SIZE GRADES

1. Crown — Raisins that at time of boxing will not pass through a screen with opening smaller than $^{12}/_{32}$ inch.

2. Crown	Raisins that at time of boxing will not pass through a screen with opening smaller than $^{17}/_{32}$ inch.
3. Crown	Raisins that at time of boxing will not pass through a screen with opening smaller than $^{21}/_{32}$ inch.
4. Crown	Raisins that at time of boxing will not pass through a screen with opening smaller than $^{21}/_{32}$ inch.
5. Crown 6. Crown	Hand sorted jumbo, generally sold in clusters.

CURRANTS

Currents are the dried fruit of the small black Corinth grape grown in Greece. The currant growing in the United States is the fruit of a bush like the gooseberry and is a different fruit altogether.

Grades

Vostizza
Patras
Amalias
Pyrgos

Patras and Amalias are most commonly imported in the U. S. A.

TAMARINDS

Tamarinds are the fruits of a tree cultivated in the East and West Indies and in Africa. The pulp found in commerce is mostly used in medicine as a purgative. But the raw fruits are also used in the manufacturing of chewing tobacco and the extract prepared from the fruits is often added to beverages, where a tart taste is preferred. The East Indian tamarind is considered the best.

CANNING OF FRUITS AND VEGETABLES

The aim of any method of food preservation is to keep food in good condition for off-seasons, when fresh fruit cannot be obtained.

Methods of canning have progressed so successfully during the past few years that, almost without exception, all foods fit for consumption can now be preserved. The particular method of preservation for long time storage to be used for a particular food should be carefully considered, whether it should be stored under refrigeration, dried, cured, pickled. Under proper and satisfactory conditions, beets, cabbage, carrots, celery, onions, parsnips, pumpkin, potatoes, sweet potatoes, turnips and apples may be satisfactorily used at later periods.

Cold storaging of fruits and vegetables is today as cheap and acces-

sible as water running from a faucet. Small cold storaging plants have sprung up throughout the country and lockers for depositing foods for cold keeping may be rented. It should be borne in mind, however, that if the temperature in the cold locker is too low, fruit or vegetable products are apt to become spoiled. The average freezing point at which the below fruits and vegetables will still remain palatcable is listed below.

Fruits and Vegetables	*Averaging Freezing Temperature*
Apples	28.5 ° F.
Cherries	27.81° F.
Grapes	28.16° F.
Oranges	28.03° F.
Peaches	29.41° F.
Plums	28.53° F.
Strawberries	29.93° F.
Blackberries and raspberries	29.4 ° F.
Potatoes	28.92° F.
Tomatoes	30.4 ° F.
Sweet Corn	28.95° F.
Onions	30 ° F.
Lettuce	31.2 ° F.
Carrots	29.57° F.
Peas	30 ° F.
Cauliflower	30 ° F.
Celery	29.73° F.
Cabbage	31.18° F.

Freezing injury does not always occur when fruit or vegetable products are exposed to temperatures at, or below, their actual freezing points. Under certain conditions, many of these products can be undercooled below the true freezing temperature and, when warmed up again, no apparent injury is noted. Certain products may be actually frozen below their freezing temperatures without injury, while some products are injured by chilling at temperatures above their actual freezing point. In view of these facts the possible danger of freezing injury must always be considered even though the temperature is somewhat above the freezing point, especially, if the food is exposed for a long period of time at cold temperatures.

SPOILAGE PREVENTION

Successful canning prevents spoilage by (1) establishing conditions whereby it is impossible for the food to come in contact with anything

which might cause spoilage, and by (2) destroying everything already present in the food which might cause it to spoil. This is accomplished by packing the food in a suitable container, applying sufficient heat to destroy any and all spoilage agents present, making the container airtight, and storing under proper conditions. If canned food has been properly packed, heated, sealed, and stored, it will keep indefinitely without spoilage. Canning powders and preservatives should never be used, as they are not necessary and may be harmful. The use of vinegar or lemon juice (formerly recommended in the canning of vegetables by the hot waterbath method) is not advisable because the method is not dependable and the flavor of the product is frequently unsatisfactory.

SPOILAGE AGENTS

The spoilage of canned food is caused either by the growth of microorganisms (molds, yeasts and bacteria) or by chemical agents. Some micro-organisms are found almost everywhere: in the air, in the soil, and on the surface of food. It is the failure to kill these organisms or to prevent their contact with food which causes all microbial spoilage. It is important, therefore, to recognize the kinds, causes, and dangers of spoilage, and to understand how spoilage can be prevented.

MOLDS

The familiar fuzzy growth produced by molds is easily recognizable. Molds usually begin their growth upon the surface of the canned food and penetrate slowly to the center. If the mold is present in small amounts, it may be removed from the surface, and the remainder of the food may be eaten with safety, as there is little evidence that moldy food causes illness. If a heavy growth of mold is present, however, the food should be discarded, as the flavor and the texture will be unfavorably affected.

Molds require air; they grow rapidly in warm, dark places, and in the presence of sugar, acid, and moisture. For this reason, jellies, preserves, fruit juices, and tomatoes are likely to be affected. Acid foods, such as fruits, when canned with a large amount of sugar, are particularly susceptible. Although molds are easily destroyed by heating for a short time at the temperature of boiling water (and sometimes even at a lower temperature if the heat is continued for a sufficiently long time), spoilage may take place if the food is heated in an open kettle, transferred to hot jars, sealed, and stored. The molds from the air may contaminate the food as it is being transferred or the molds may be in the jars if they have not been properly sterilized. Molds will not spoil canned food if

the jars containing the food are heated in a boiling water-bath long enough to kill the molds and are then adequately sealed.

YEASTS

Yeasts are micro-organisms which often cause canned fruits and fruit products to ferment. Fermented products usually have a fermented appearance, a sour taste, and an alcoholic odor. One of the products of fermentation is carbon dioxide; the gas accumulates and, even though there may be no outward sign of spoilage, there may be an outburst of gas or a spurt of liquid when the container is opened. If sufficient gas accumulates, it may break the seal of a glass jar so that the contents leak out, and occasionally a jar may "blow up." Spoilage of this kind in foods canned in tin causes the ends of the cans to round outward. The trade term for such cans is "swells." Any gas, however, will produce the same result, and the source of the gas is not always the carbon dioxide produced by yeasts.

Tomato products and fruit products may be spoiled by yeasts which grow in the presence of acid and sugar. Yeasts are destroyed, even more easily than are molds, by heating for a short time at the temperature of boiling water; they are more easily killed in unsweetened fruit juice than in juice containing a large amount of sugar. As with molds, yeasts may cause the spoilage of a food if it is heated in an open kettle, transferred to hot jars, sealed, and stored. There is no danger of fermentation, however, if the jars (with the food) are heated in a boiling-water bath long enough to kill the yeasts and are then adequately sealed and stored.

BACTERIA

Bacteria are the chief sources of trouble in canning because they may exist in resistant forms, called endospores. These are not always destroyed at the temperature of boiling water and may later develop when the canned food is stored and cause bacterial spoilage.

Bacteria are easily killed by heat in the presence of acid; therefore, such acid foods as fruit products and tomatoes, when canned by the boiling water-bath method, are not subject to bacterial spoilage. Non-acid foods (e.g., meat and vegetables other than tomatoes) however, may be heated in containers in a boiling water-bath for as long as six hours without destroying the spores of certain bacteria. The reason for spoilage can usually be traced either to inadequate heating, as (1) heating in a boiling water-bath, steamer (212° F. is about the highest temperature which the food reaches by these kinds of heating), instead of in a pressure cooker, (2) heating at too low a pressure when a pressure cooker is used, or (3) heating for too short a time, or (4) the absence of an air-tight seal.

To prevent the spoilage of meats and non-acid vegetables, therefore, a pressure cooker must be used, since only in this way is a temperature obtainable which is sufficiently high to kill the spore forms of the bacteria (from 240° to 250° F.).

Bacterial spoilage causes a number of conditions which may result in cloudiness, softness, putrid and disagreeable odors, gases, acids, or other "off" flavors and toxins.

CLOUDINESS AND SOFTNESS

Cloudiness and softness alone do not necessarily indicate spoilage, but food with such an appearance should not be tasted until it has been boiled actively for 10 minutes. If an odor develops during boiling, the food should be discarded without tasting.

PUTREFACTION

Food which has begun to putrefy gives off a disagreeable odor—and should be discarded without tasting.

GASES AND "SWELLS"

Certain bacteria produce gas which, like the gas from yeast, may cause: (1) the end of tin cans to bulge, (2) containers to set free an explosive puff of gas or spurt of liquid when they are opened, (3) jars to leak, or (4) jars to "blow up." Food from such containers should be regarded with suspicion. If bacterial spoilage has taken place, the product has usually a sour or putrid odor and, sometimes, a foamy appearance. Any food showing such a spoilage should be discarded without tasting. If the food does not show spoilage, it should be heated. If the food neither looks nor smells unusual after it has been heated, it should be boiled actively in an open vessel for 10 minutes, and then tasted. If the food is wholesome, the swelling probably is due to overpacking and not to the formation of gases during spoilage. If fruit is canned in tins, the acid present may have acted on the tin to produce a harmless gas with no harmful effect on the product.

ACIDS AND FLAT SOUR

Other bacteria produce acids which give the canned food a sour taste. No gas is formed, however, and the ends of the spoiled cans, therefore, remain flat. There may be no evidence of spoilage until the container is opened; then the food usually has a sloppy appearance, a cloudy liquid, an unpleasant odor, and a sour taste. Such food should be discarded; peas, asparagus, corn, lima beans, and string beans are particularly susceptible to this type of spoilage. The damage is usually caused by

thermophilic, or heat-loving, bacteria, which require heat for their development. Such spoilage can be reduced to a minimum by packing the food into the jars quickly, heating the jars promptly after they are packed, cooling them immediately and thoroughly after they have been heated, and storing them in a cool place.

TOXINS AND BOTULISM

Some bacteria during their growth produce extremely poisonous substances called toxins. One of the most dangerous of the toxin-producing organisms is Clostridium botulinum, an organism found in the soil, which causes botulism, usually a fatal disease. Unfortunately, signs of spoilage, which can be detected by casual observation are not always evident when the fatal toxin has been produced. Sometimes a gas is formed together with the toxin, so that "swells" are produced. The food may have a dark or mushy appearance and a cheesy or putrid odor. Food showing evidence of such spoilage should be discarded without tasting, for one taste may prove fatal. The toxin is rare but may be present in other forms of bacterial spoilage. It has been found in home-canned meats, in soup mixtures, and in such non-acid vegetables as asparagus, corn, greens, peas, and string beans which have been canned at the temperature of boiling water. Acid foods, such as fruit products and tomatoes, are not subject to this type of spoilage because the organism does not develop and produce its toxin in an acid medium. The bacteria produce heat-resistant endospores which are harmless themselves, but which, if not destroyed during the heating period, develop in the cans during storage, and produce the poison. To insure the destruction of the spores, meat and non-acid vegetables must be canned in a pressure cooker, for this is the only method whereby a temperature high enough to kill the spores can be obtained. The canning of meats and non-acid vegetables by methods other than the pressure-cooker method is unsafe and cannot be recommended; these foods should be preserved by methods other than canning, if pressure cooking is not possible. Because of the danger of poisoning from toxins, the Bureau of Home Economics, at Washington, D. C., recommends that all home-canned meats and vegetables be removed from the can, brought to a boil, and boiled actively in an uncovered vessel for 10 minutes before they are tasted, to destroy the toxin if it is present. The treatment is, of course, applied only to food that appears wholesome; other food should be immediately discarded.

CHEMICAL AGENTS

Chemical changes may be of two kinds: (1) a reaction between the food and the material of which the container is made, and (2) enzyme

action. When fruit is canned in tin, the acid may attack the tin and produce hydrogen gas, with the production of hydrogen "swells." The food, although it may be bleached, will otherwise have a normal appearance and will be wholesome. When corn is canned in tin, discoloration may take place because of chemical action. In order to avoid this action as much as possible, the product should be canned in glass or in enamel-lined containers recommended by the manufacturer for that particular product.

The most noticeable effect of enzyme action is discoloration. If the food is in a glass jar, the top surface may first turn brown, then black. Much discoloration produces a food of very poor quality and, at best, the taste is somewhat unfavorably affected. The discolored portions should be discarded, although the remainder of the food may be used if no objectionable odor develops after it has been boiled for 10 minutes. The development of any foreign odor indicates that other spoilage has taken place, in which case the food should be discarded without being tasted.

To prevent this type of damage, the canned products should be stored in a cool place, since chemical reaction is retarded at lower temperatures.

CANNED FOODS

CANNING METHODS

Commercial canning methods for all food products are similar, but minor variations are required by different foods. Prompt delivery of the raw products is of the greatest importance, since most vegetables and fruits, change or deteriorate rapidly after gathering. (So important is the matter of freshness that canneries are usually located near the farms or orchards.) Peas, corn, asparagus and green beans are all seriously injured by standing, while berries must be collected in shallow lug boxes to prevent bruising. The milk collected for the evaporated product must be even fresher and cleaner than that generally delivered in city markets, and fish must be brought to the canneries by special boats employed for the purpose.

On arrival at the cannery the loads of vegetables, fruit, or fish are first given a general examination by the superintendent. The next step is to sort for condition and size, which is usually done by machinery. After the product is shelled, husked, peeled or trimmed (as its nature may require), it passes to machines where it is thoroughly washed. Some products are then filled into the cans after preliminary heating or cooking; others are packed cold and then passed through a steam chamber known

as an "exhaust box" in order to heat the contents before the can is closed. Mechanical fillers are usually employed.

The filled cans are passed under a machine called a capping machine, or "double seamer," which places a cover on the can and clamps it on air-tight by a rolled seam. The cans are then carried mechanically by a conveyor to the process kettles, where the product is cooked, either in boiling water or under pressure. The time and temperature of the cook, or "process," depends on the nature of the food product. As many products are extremely perishable and must be expeditiously handled if they are to be of the best quality, the aim of the modern canning plant is to get the product into the can and cooked just as quickly as possible. In modern plants the product is usually in the cans within a very short time after the raw material has been received. The delicious flavor of many canned foods is due to this quick handling, and the fact that the raw products are gathered at the best stage of ripeness. In most canneries, after the preliminary handling, the product is not touched by hand.

SORTING, CLEANING AND TRIMMING

In an endeavor to prepare a properly finished product, various methods for sorting, cleaning and trimming have been devised. Practically every product now canned goes through these three processes.

Where the nature of the product permits, the sorting is done by machinery, but in many cases is still done by hand. The sorting consists of a series of processes—general sorting before the product is washed and cleaned and a final sorting before the product goes into the cans. The purpose is two-fold—to remove the damaged or inferior material in the raw product as it arrives at the cannery, and to separate the material into various sizes. The latter might more properly be called grading for size.

The most ingenious machines have been perfected to wash and clean fruits, vegetables, fish, etc., before they are finally put into cans. Many of these machines are so arranged that a continuous stream of water is sprayed on the product, which, in many cases, is mechanically scrubbed by brushes. Such products as peas, beans, fruits, etc., after a thorough washing are passed over long tables or traveling belts, where imperfect vegetables or fruits and any foreign materials are removed by hand. This insures a clean, sound product for canning.

BLANCHING

Certain vegetables and fruits are given a preliminary cooking in hot water before they are packed in the cans. This treatment is known as "blanching," and is varied in degree, according to the size and maturity

of the product, so that even though the final sterilizing process is the same for a given product and size of container, the contents will all be cooked to the proper degree of tenderness. The blanching treatment not only softens the raw product so that the cans may be filled properly, but also serves as a preliminary cooking treatment and removes gummy substances from the outside of certain vegetables (e.g., peas and beans), which would make the liquor in the can more or less cloudy.

FILLING

While fruits and fish (except salmon in tall cans) are filled into cans by hand, vegetable and milk cans are generally filled by mechanical fillers. Hand-filling is necessary with the former to secure the proper fill without crushing or breaking up the food. Hand-filling is checked by weight, while mechanical fillers are generally designed to deliver a definite volume into each can.

When syrup or brine is used, or oil for sardines, it is added by mechanical fillers, adjusted to deliver a certain volume in each can.

PREHEATING OR "EXHAUST"

The next step in the canning process (employed chiefly when products are filled cold into the can) is to give the cans a preliminary heating, or "exhaust." This is done by passing the filled cans on a conveyor through a steam chamber or hot water tank for five to ten minutes. Products such as corn, which is filled into the can while hot, and peas, which are covered with a hot brine, are ordinarily not exhausted; tomatoes, which are packed cold, are generally exhausted. The purpose of the exhaust treatment is to produce a partial vacuum in the can after it is closed and finally cooled, so that the ends of the can will be flat or concave and will not bulge.

In recent years machines have been devised which produce a partial vacuum in the cans by sealing them in a chamber from which the air has been partially exhausted.

CLOSING

The open-top can is closed by an automatic closing-machine known as a "double-seamer." The edge of the cover and the flange of the can are first clamped together and then rolled under. To make the seam airtight, a gasket is used, composed of paper or of a rubber compound spread on the edge of the cover.

PROCESSING

Success in canning depends largely upon the "process," that is, proper sterilization by heat. A knowledge of the principles of sterilization and sanitation is something that every successful canner must have and put into practice. The increase of such knowledge is one reason why canned foods, as a class, are second to none in cleanliness and wholesomeness. The commercial canner has the advantage of producing his own raw materials or securing them directly from the farmer or grower; he is also equipped to process or sterilize canned foods by methods best adapted to each product.

Acid products such as tomatoes and fruits can be readily sterilized at temperatures not over 212° F., but most vegetables, meat, fish and milk require a considerably higher temperature to sterilize them within a reasonable time.

Four types of equipment are used for processing or sterilizing canned foods, viz., (1) open bath, (2) retort or pressure cooker, (3) continuous cooker, and (4) agitating cooker.

The open-bath cooker is simply a large tank or trough containing water, heated by open steam coils, in which the cans are immersed, usually in metal crates or by means of a mechanical conveyor. In such cookers the temperature cannot exceed 212° F., the boiling point of the water.

The retorts, or pressure cookers, are made of steel boiler plate and have a lid which can be fastened down air-tight. After the cans are placed in the retorts, the retorts are closed and steam under pressure is admitted. For some products the temperature is carried up to 250° F., and the period of heating, to complete sterilization, varies from twenty minutes to three hours, depending on the product and the size of the containers. Either vertical or horizontal retorts may be used, which have steam and cold water connections and are equipped with thermometers and pressure gauges.

A continuous cooker is one provided with a conveyor system which carries the cans through the cooker, thus making it continuous in operation. Either hot water or steam may be used for heating, and continuous cookers of special construction are made so that heating can be done under pressure if desired. By regulating the speed of the conveyor or changing the point of exit for the cans, the cooking time can be closely regulated.

Agitating cookers are similar to continuous cookers, but are provided with an arrangement for turning the cans in the cooker, which makes cans of semi-solid products heat through more rapidly.

COOLING

As soon as the sterilizing process is complete, the cans are cooled. Cooling is essential for many products to prevent over-cooking, and is done either by water, or by spreading the cans out in the warehouse so that the air circulates freely among them. In water cooling three methods are commonly used: (1) the retorts may be filled with cold water before the cans are removed, (2) the cans may be conveyed from the cooker through a tank of cold water, or (3) they may be placed under sprinklers.

SYRUP AND BRINE

In canning fruits and vegetables, as previously mentioned, brine or syrup is usually added, as a certain amount of liquid is usually necessary in the canning process to secure proper sterilization and to retain the desired flavor and consistency. The syrup or brine is, therefore, as essential a part of the product as the fruit or vegetable itself.

With the exception of the water or pie grade of fruit (which is packed in water and sold largely to be manufactured into other products, such as pies, fruit syrups and preserves) all grades of canned fruit are packed with syrup of varying degrees of strength. The strength of the syrup in the finished product is not the same as that of the added syrup, because of the gradual diffusion of the juice of the fruit into the syrup. As the amount of juice present and of syrup added vary somewhat with the condition of the fruit and fill of the can, it is impossible to tell exactly the strength of the original syrup, but it is possible to make an approximate estimate.

In commercial practice, syrups for canning are made up to a definite sugar strength (as measured by degrees upon the Brix scale) and tested by a hydrometer adjusted to give direct readings on that scale. For example a 20° syrup, Brix scale, is prepared by dissolving 20 pounds of sugar in 80 pounds of water to make 100 pounds of syrup.

Syrup in the canned fruit may be tested by the hydrometer, just as with plain sugar syrup. The hydrometer reading will then depend not only on the amount of sugar added in the form of syrup, but also on the amount of sugar and other soluble substances naturally present in the fruit. It will indicate approximately the total percentage of sugar in the liquid contents of the can.

Most vegetables are canned with the addition of a certain amount of brine, which serves the same purpose as syrup in canned fruits. The use of brine in canned foods is subject to the same restrictions as govern the use of syrup. The brine is a weak solution of common salt (1½–2%) or of salt and sugar, the choice being determined by the character of the

product and the flavor desired. Some vegetables (e.g., sweet potatoes, tomatoes and pumpkins) do not require the addition of any brine.

GRADES AND QUALITIES

Raw products for canning, particularly fruits and vegetables, are usually graded for size or quality, or for both, this being one of the first steps in the canning operation. Quality grading is often closely associated with the size of fruits and certain vegetables, and it is an interesting fact that in the case of fruits, the larger sizes go into the higher quality grades, while the reverse is true of vegetables such as peas, beans and beets. Grading for size is largely done by machinery, and grading for color, defects, etc., is done by hand and eye.

FRUITS

The designation of the three grades of quality used by fruit canners in this country for table fruit are, in order of quality: Fancy, Choice and Standard. In addition, there are two lower grades packed in very light syrup or in water and variously designated by such terms as "Seconds," "Natural," "Water," or "Pie" grade. The lower grades usually consist of undersized or irregular fruit or fruit which is either too ripe or not ripe enough for table fruit, but is, nevertheless, sound and wholesome.

A good idea of the quality of canned fruit may be obtained from the general appearance of the product. Generally speaking, the quality of the fruit governs the style of its preparation. A heavier syrup is used on the higher grades, and in case of the large fruits, like peaches, pears and apricots, the larger and more uniform fruit goes into the higher grades. With certain of the smaller fruits, the quality of the fruit in the higher grades does not differ materially from that in the lower grades, the difference being largely in the amount of sugar used. The lower grades are usually canned with very little sugar, or in water. A cheaper but wholesome article is furnished in this way to meet the great demand for the manufacture of pies and various fruit products. The quality of fruit used in the lower grades is subject to much greater variation than that in the higher grades.

The grading of peaches illustrates very well the principle governing the grading of the large fruits. For Fancy grade, perfect stock in the best state of ripeness is used and handled with particular care. The fruit must be large enough to take not more than 12 pieces (halves) to fill a No. 2½ can; a 55° syrup is added. For Choice grade, the fruit must be nearly perfect but need not be so large, the limit being 15 halves per can; a 40° syrup is used. The limit for Standard grade is 21 halves of good but less uniform fruit and the strength of the syrup is 25°. The so-called "Sec-

ond" grade calls for sound fruit of fairly uniform size and ripeness, without any definite size limits, packed in 10° syrup. The "Pie" grade simply requires sound, wholesome, fruit packed in water in large cans, chiefly for the manufacture of other food products. In the lower grades, the fruit is of smaller size, may be a little under-ripe or over-ripe, may lack uniformity and, though sound, may contain some blemishes.

The smaller fruits are usually graded only for quality, which is based largely on uniformity of color, size, flavor and freedom from damaged fruit.

VEGETABLES

There are in commercial use three grades of quality for canned vegetables, the grades generally being Fancy, Extra Standard of Choice, and Standard. Other designations are also used, based upon the size of the material, such as the number of stalks in a can of asparagus or the size of peas.

The grading of vegetables varies for different products. Grading of peas is carried to an extreme, so that a canner may put up fifteen or more grades of the same variety. This is due to the usual grading of peas into five or six sizes and three or four quality grades. On the other hand, such products as pumpkins and sweet potatoes are packed in only two grades, Fancy and Standard.

The condition of the food product is the chief factor in determining vegetable quality grades. The composition of the brine or liquor is independent of the grade, although in a Fancy grade of corn, for example, more sugar is usually added in the brine than in the Standard grade.

Fancy grade calls for materials of the highest quality and flavor, uniform in color and size, handled with special care. Standard grade is prepared from sound material, usually about average run of the crop, so that it may lack uniformity in size, color and ripeness. The Extra Standard or Choice grade is intermediate between Fancy and Standard, and applies to a product that falls slightly below the rigid requirements of the Fancy grade, but is still better than Standard.

OTHER PRODUCTS

Evaporated and condensed milk are not graded, but must comply with the Government standards in fat and total solids content.

Canned meats and meat products are not graded, but are subject to the rigid inspection and regulations of the Federal Meat Inspection Service. This includes also canned stews and soups with a meat base.

Canned salmon and tuna are graded for species and color of flesh in

the can, while sardines are graded for size according to the number of fish per can. Oysters and shrimp are graded only for size.

METHODS OF CANNING TYPICAL PRODUCTS

VEGETABLES

Asparagus

The canning of asparagus differs considerably from the canning of most vegetables in that a large amount of hand labor is involved. Promptness at every step of the harvesting and canning process is especially necessary to prevent deterioration and loss of flavor. The plants are set in rows and covered with a deep layer of soil so that long stalks are sent out by the plant in order to reach the surface. The stalks or portions of stalks that are not exposed to light are white, and these are generally preferred to the green stalks that grow above the ground. The stalks are harvested by hand, washed and cut to uniform length in the field and then hauled to the cannery.

Before being canned the asparagus is sorted into grades, both as to color and as to size of stalk. It is then blanched and packed into cans by hand (both round and rectangular cans being used), brine is added, and the cans are sealed and processed.

Beans

The canning of beans has grown to very large proportions in recent years. They are packed with plain sauce, with tomato sauce, with pork, or with both pork and tomato sauce. Dried white pea beans or navy beans of the grade known as "choice hand-picked" are generally used; these are grown principally in Michigan, New York and Wisconsin.

The beans are first soaked in tanks of cold water from ten to fifteen hours, with frequent changes of water. Sometimes a short blanching of the beans helps to secure prompt and uniform swelling. The beans are then blanched in hot water for several minutes, a blancher of the same type as the pea blancher being commonly used. Some beans are also cooked in jacketed kettles or ovens. Such a dry heating process is necessary to entitle the product to the term "baked beans," under the ruling of the United States Bureau of Chemistry.

Plain sauce for canned beans is prepared from molasses, sugar, salt and water. Tomato sauce is made from the same ingredients, with the addition of tomato pulp and spices. In canning beans with pork, a piece of pork is placed in each can before it is filled with beans and the sauce is then added. Finally the cans are sealed and processed under pressure.

Red kidney beans are canned to a considerable extent by similar methods.

Green and Wax Beans

Great improvement has been made in the varieties of green and wax beans grown for canning with regard both to color and to elimination of "strings."

The beans are hand-picked while young and tender and are brought in boxes to the cannery, where they are graded for size and snipped mechanically. The larger sized beans are also cut into even lengths by machine. No. 1 grade are beans which pass through a $\frac{3}{16}$-inch opening, while the largest, or No. 5, grade are too large to pass through a $\frac{5}{16}$-inch opening.

Hand sorting is often necessary with wax beans to remove defective beans.

Lima Beans

Lima beans have long been cultivated in this country for canning and drying as well as for direct table use. The lima bean is believed to have originated in South America. Two types are cultivated in this country, the bush or dwarf varieties and the long-vine or pole varieties. The young, green beans are the highest grade of product, as the beans become more starchy as they mature, lose their green color and are less attractive in appearance.

Canned lima beans prepared from dried California beans are also packed to a considerable extent. They are required to be labeled to distinguish them from green canned beans.

Lima beans are harvested on the vines and the beans are separated by means of vining machines like those used for shelling peas. The beans are mechanically graded for size and are picked over by hand to remove foreign matter and separate green from white beans. The beans are then washed, blanched, and packed with hot brine in cans, which are sealed and processed under pressure.

Succotash

Both fresh and dried lima beans are largely used with sweet corn in preparing canned succotash. Where fresh beans are used, varieties of corn and beans which mature together are selected and planted for the purpose. The preliminary preparation of the beans is the same as already described. After the corn and beans are mixed the product is treated as in the case of corn. The usual proportion of lima beans in succotash is 20 to 30 per cent.

Corn

Sweet corn for canning is grown in the northern part of the United States, from the Atlantic Coast to the Missouri River valley. In the Eastern States the crops are generally grown by farmers on contract, while many of the Western canners raise their own corn. The effort of canners is to develop a tender, fine-flavored sweet corn. The seed is especially selected and grown in regions which have been found to be best suited for producing the finest quality. The principal varieties of sweet corn canned are Evergreen, Country Gentlemen, Crosby and Golden Bantam.

Canned corn is put up principally in two forms—whole-grain style and cream style. In the former, the kernels are simply cut from the ears after husking, while in the latter the upper portion of the kernel is cut off and the creamy contents of the lower portion are forced out by means of scrapers, which leave a large portion of the fibrous part of the kernels on the cob. Both types of product are freed mechanically from silk and pieces of cob and are packed in cans with the necessary amount of hot brine, to which sugar is usually added. The contents of the cans are heated nearly to the boiling point and, after the cans are sealed air-tight, they are cooked and sterilized under pressure in such a way as to affect the appearance of the product as little as possible.

Hominy

Canned hominy is a convenient form of vegetable and breakfast food and is a staple article of diet in camps. Lye hominy was a staple food of the early settlers, who used lye prepared from wood ashes to soften and remove the corn hulls. For canning, lye hominy is prepared from white corn, which is screened, washed and treated with hot lye solution for a sufficient time to loosen the tough hulls, which are removed in a mechanical hulling machine. The hulled corn is then thoroughly washed to remove lye, cooked till tender and packed in cans. Weak brine is added and the cans are sealed and processed under pressure.

Beets

Only red varieties of garden beets are used for canning, and they are planted so as to reach the desired small size in the Fall. This ensures a maximum of tenderness and prevents the development of large, coarse-fibered beets.

In the cannery the beets are graded for size and thoroughly scoured mechanically. They are then steamed in retorts to facilitate peeling, and are peeled and filled into cans by hand. Hot water or weak brine is added

and the cans are sealed and processed under pressure. Enamel lined cans are used to prevent bleaching of the red color. Large beets (by which is meant beets over 2 inches in diameter) are cut into pieces before being canned, and are sold as cut beets. Small and medium size beets are canned whole or sliced.

Peas

Peas are one of the staple canned vegetables. The quality of the product has been continually improved by the selection of types of peas grown especially for canning, and by the development of better machinery and equipment for handling them promptly in very large quantities. In modern canneries peas are not touched by the human hand from the vine to the can, except defective peas removed at the picking tables as described later.

Peas are successfully grown for canning in nearly all the northern states and are of two types, viz., the smooth, early pea or Alaska type and the sweet, wrinkled type. After they are canned, the Alaska peas may generally be distinguished from the other types by their more uniformly round appearance.

Peas in the same pod vary considerably in size, from the big ones to the middle down to the small ones at each end. Therefore, the canner must judge by experience the best time to gather the peas to secure not only the largest yield, but also the most desirable size and degree of tenderness. To spread the canning season out and prevent the peas from maturing all at once, the planting is extended over several weeks so as to give a fairly uniform supply that can be conveniently handled.

When peas in the field have reached the proper stage, they are harvested, vines and all, and hauled to the cannery or vining station, where the peas are separated by a special type of threshing machine known as a "viner." The shelled peas are next freed from leaves, pieces of pod and loose dirt by passing them in front of a blower or fanning mill and over vibrating slotted screens. The peas are also washed under sprays of cold water, this washing process taking place either before or after they pass through the graders, which are a series of large horizontal cylinders perforated with round holes, graduated in size, and which separate the peas into five or six different sizes. Although some very tender peas are canned without being graded, it is generally more satisfactory to grade them to achieve uniformity. By separating the different sizes, the canner is able to vary the method of preparation for each size to yield the most satisfactory product.

After being washed, the peas are carried on moving belts past women pickers, who sort out defective peas or foreign materials that may have

escaped in the previous treatments. The peas are next blanched or given a preliminary cook in a large cylinder revolving in a tank of hot water. The peas are fed continuously through this "blancher" and the length of cook is adjusted by varying the rate of revolution of the cylinder. After another washing, the peas are conveyed to fillers—machines which automatically measure and fill the peas into the cans and add hot brine. The cans are promptly sealed and processed in retorts under pressure.

Canned peas are graded for quality, as well as for size, so that it is not unusual for a canner to produce as many as twelve or fifteen grades of peas. The terms "fancy," "extra standard" and "standard" are used to describe quality grades, while the expressions "petit pois," "extra sifted," "sifted," "Marrowfat," and "telephone" apply to sizes. The term "early June" was originally used to designate a certain sized pea, but it is now generally applied to any peas of the early, smooth type.

Pimientos or Sweet Peppers

Until a few years ago canned pimientos were imported chiefly from Spain, but pimientos of equally good quality and of fine red color are now produced in the South and in California. After being delivered at the cannery, the peppers are usually graded for size. Two methods of coring and peeling are used; by one method the whole peppers are immersed in hot oil to loosen the skin and, after being cooled, they are peeled and cored by hand. In the other method, the peppers are cored by cutting off the stem end and removing the core and seeds, either by machine or by hand. The peppers are then passed on a conveyor through a roasting furnace, which parches the skin and makes it easy to remove. The skins are removed by passing the roasted peppers through cylindrical washers, and the peeled peppers are then sorted and packed in cans, exhausted, sealed and processed.

Pumpkin and Squash

Pumpkin and squash are canned to a considerable extent and are handled in the same way. In recent years decided improvement has been made in the methods of canning. The pumpkins on arrival at the cannery are washed, stemmed and cut into pieces with cleavers or by slicing machines. The seeds are then removed by washing under strong sprays or by a mechanical shaker of perforated metal, through which the seeds can pass but not the pieces of pumpkin. The cut pumpkin is then either placed in crates and cooked in closed retorts or is steamed in large covered tanks until thoroughly softened, after which it is conveyed to a "cyclone," or horizontal cylindrical sieve with inner paddles revolving at a high rate of speed, which removes pieces of skin and coarse fibre.

If the resulting product is too thin and watery, it is thickened by pressing or draining to the desired consistency and may then be passed through another "cyclone" with finer mesh to give the product a smooth body. It is then filled into the cans while hot, sealed and processed under pressure. Pumpkins and squash are now generally packed in enameled-lined cans.

Sauerkraut

Sauerkraut is cabbage which is subjected to a process of fermentation that converts the small amount of natural sugar in the cabbage to lactic acid, and gives the product the acid flavor characteristic of sauerkraut. The cabbage is trimmed mechanically, shredded, and packed tightly in large vats or tanks and sprinkled with dry salt. If it is not too cold (70° to 85° F.), the fermentation soon starts and proceeds for two to four weeks (depending on the temperature), after which the product is ready for packing. The sauerkraut is filled into cans by hand, covered with hot water or brine, and then exhausted, sealed and processed in boiling water.

Spinach

Spinach for canning is grown in the spring and the fall, as cool weather is necessary for the production of a tender and succulent product. On arrival at the cannery, the spinach is picked over by hand to remove coarse stems and leaves that are discolored or too mature. It is then washed in a cylindrical washer under strong sprays; revolving paddles are often used to stir up the leaves and insure removal of all dirt and grit. The washed spinach is blanched in hot water for a few minutes and filled into cans while hot. Brine is next added and the cans are exhausted, sealed and processed under pressure.

Sweet Potatoes

Sweet potatoes are a valuable food, rich in starch and sugar, but (unlike white potatoes) spoil easily in ordinary storage. Canned sweet potatoes, although a comparatively new product, have, therefore, met with popular favor by making this vegetable available throughout the year.

When received at the cannery, sweet potatoes are graded for size, as subsequent treatment depends to some extent on the size of the potatoes. They are next placed in crates and steamed in retorts for sufficient time to loosen the skins and cook the potatoes. As soon as the potatoes are cool enough to handle, the skins are stripped off by hand and the potatoes are packed tight into cans while still hot. The filled cans are given a long exhaust, and are then sealed and processed at 212° F.

Tomatoes

Tomatoes are canned in nearly all sections of the United States, and the average annual output for the past ten years has been about 11,800,-000 cases (equivalent to about 590,000,000 pounds). In addition to being one of the most important canned vegetables from the standpoint of annual output, the tomato is easily first in the variety of products which it yields; these include canned tomatoes, tomato pulp, tomato puree, and tomato paste. Other canned products of which tomatoes form an essential ingredient are catsup, chili sauce, tomato soup, tomato sauce, okra and tomatoes, baked beans, spaghetti with tomato sauce, and sardines in tomato sauce.

Canned tomatoes are customarily packed and designated under three different grades: Fancy, Choice or Extra Standard, and Standard. The difference in these grades depends largely upon the brightness and uniformity of the color and the proportion of whole tomatoes or large pieces contained in the can. Special varieties of tomatoes have been developed by careful selection and breeding, which are distinguished for their bright color, size and comparatively smooth exterior.

Tomato canneries are located in the center of tomato-growing districts and the canner usually buys his tomatoes from the grower by contract. In this way it is possible to secure tomatoes of the best quality for canning purposes and to assure their prompt delivery to the cannery in the best possible condition.

Tomatoes are delivered in baskets or boxes to the cannery and are washed in a mechanical washer; spray washers supplying jets of water under pressure are now largely used for this purpose. From the washer, the tomatoes are passed through a scalder, where they are subjected to the action of live steam for a few seconds, to loosen the skin and make the subsequent peeling easy. They are then generally given a short spray of cold water and are carried to the peelers' tables, either in pails or on conveyor belts. Tomatoes are usually sorted, peeled and trimmed by hand, but mechanical tomato peelers have also been used to some extent in recent years.

After the tomatoes are peeled they are delivered in buckets to the fillers. The sorting and filling of fancy tomatoes is usually done by hand, while tomatoes of the standard grade are usually filled mechanically into the cans. The filled cans are then passed through the exhaust box, after which they are sealed and processed.

Tomato Paste and Puree

These are more or less concentrated tomato products, especially convenient for use in the preparation of various dishes. The tomatoes for making tomato paste or puree are washed, scalded, sorted and trimmed. They are then run into a machine called a "cyclone," which consists essentially of a cylinder made of fine screening with a revolving inside paddle, which separates the skins, cores and seeds.

The liquid juice and pulp is then concentrated by boiling in large kettles, which may be done under vacuum for the more highly concentrated paste. It is finally run through a "finisher" (a machine similar to the "cyclone" but with a finer mesh screen) and then packed in cans. Cans holding from 5 to 6 ounces are used for tomato paste and those holding 10 ounces to 6½ pounds, for tomato puree.

FRUITS

Apples

In canning apples, several methods are used, the nature of the canned product varying accordingly. The varieties usually canned are those best adapted for cooking purposes, fairly uniform in shape, mildly acid and of fine texture. The canning method largely in use up to a few years ago consisted of peeling, trimming and coring the apples, packing them in cans, exhausting the cans for a few minutes, adding hot water, and sealing and processing at about 212° F.

A number of changes have been effected by the introduction of efficient peeling, coring and slicing machines, and by the practice of immersing the peeled fruit in warm water or in a weak salt solution to prevent discoloration and to use up the oxygen naturally present in the cells of the fruit, which may cause trouble later. Air is sometimes removed from the fruit by immersing it in water in a retort and then producing a high vacuum in the retort.

For solid-pack canned apples, which have gained considerable popularity in the past few years, the apples, after the preliminary preparation described above, are placed in a warm, weak salt solution for thirty to forty minutes. The treatment is for the purpose of getting rid of the oxygen contained in the cells of the fruit, which would otherwise cause darkening of the fruit when heated. The apples are then blanched for a few minutes with steam, which makes them soft and flexible so they can readily be packed solid in the cans, which is the next step. The cans are then exhausted, sealed and processed.

Apple sauce is prepared from peeled, cored and trimmed apples which

are thoroughly cooked with sugar and then run through a mechanical sieve or cyclone.

To a limited extent, apples are canned whole, after being peeled and cored.

Apricots

Canned apricots are almost entirely a Pacific Coast product, as in no other part of the country has the cultivation of this fine table fruit reached such a large scale development. The raw fruit is gathered and handled in much the same manner as peaches.

The apricots are first mechanically graded for size, then washed, trimmed if necessary, split and pitted. Few canned apricots are peeled, for the skin is so tender that peeling is not necessary. The pitted fruit is then packed into cans by hand, the packers separating the pieces according to quality. The large, uniform, bright-colored pieces go into the Fancy grade, the Choice grade is a little smaller, while the Standard grade is still smaller and may show slight blemishes and lack some uniformity in color. The small, irregular, but sound fruit goes into the two still lower grades, viz., second and pie grades. The syrups added in packing these grades are 55°, 40°, 25°, 10° and water, respectively. The cans are then thoroughly exhausted, sealed and processed at 212° F.

Apricots that are over-ripe and too soft for canning may be cooked down in kettles, with or without sugar, to form apricot pulp, which is packed in large cans for manufacturing purposes.

Berries

Blackberries, raspberries, loganberries and strawberries are canned by very similar methods. For transportation to the cannery, berries are picked either in the shallow quart boxes used in the retail trade, or in shallow trays that are, in turn, packed in crates with space between each tray to prevent the crushing or bruising of the fruit.

The berries are picked over, sorted and washed, either by being conveyed through a series of sprays or by hand dipping. Red raspberries are usually not washed, as they are very tender and break apart easily.

The cleaned fruit is then packed in cans by hand, hot syrup is added, and the filled cans are exhausted, sealed and processed at about 212° F. Syrup containing 10 to 70 per cent sugar is used, depending on variety and grade. Enameled-lined cans are generally used in canning red berries, to preserve the color and flavor.

As blueberries are gathered by the use of special hand "rakes," they are mixed with leaves and stems, which are separated out by passing the fruit through a fanning mill. The berries are also picked over by hand to

remove green fruit, leaves and stems. They are then cooked with live steam and the hot product is filled into cans and sealed up.

Many blueberries are packed in No. 10 cans in water for baker's use, as well as in No. 2 cans in sugar for the table. They are usually not processed after sealing, the acid character of the fruit preventing spoilage when the cans are filled hot.

Cranberries

A number of firms in New England and New Jersey can cranberries in the form of either cranberry jelly or cranberry sauce. The berries are gathered in the cranberry bogs by the use of special rakes, and upon arrival at the cannery they are cleaned, sorted, washed and cooked in steam-jacketed kettles with the desired amount of sugar or syrup. The cooked product then passes through a mechanical pulper or "cyclone" to remove the skins, and the strained sauce or jelly is filled into cans and sealed.

Cherries

Cherries used in canning are of two general classes—the sweet cherries packed on the Pacific Coast and in New York State, and the red sour cherries of the Northeastern and Central states. The Royal Anne, a white cherry, is by far the most important sweet cherry canned, though black cherries, chiefly Bings and Lamberts, are packed to some extent. The principal varieties of red sour cherries canned are the Montmorency and the Early Richmond. For table use, sweet cherries are packed in syrup and they are nearly always canned with the pits, while sour cherries, being used largely for pies and preserves, are generally pitted. The syrup added runs from 10 to 70 per cent sugar, depending upon the variety and grade.

Sweet cherries are stemmed and graded for size before being canned, the quality grades (Fancy, Choice, Standard, etc.), depending on the size, freedom from blemishes, and the strength of syrup used. Sour cherries are graded only according to uniformity of color and strength of syrup.

The stemmed fruit is hand picked to remove defective fruit and then washed. Sour cherries are pitted by means of a special machine, consisting of a horizontal revolving cylinder on the circumference of which are rows of small pockets with a hole in the bottom of each. As the cylinder revolves, the cherries drop into these pockets from a hopper, and the pits are punched out through the holes by a set of plungers. The fruit is then filled into cans with syrup or, in case of sour cherries in No. 10 cans, with water, and the cans are exhausted and processed in boiling water.

Figs

Figs are canned to a considerable extent in some of the southern states and in California. The varieties used for canning differ from those prepared as dried figs. The canning procedure is simple, the fruit being generally left unpeeled and packed in a medium syrup. Put up in this way, the natural appearance and flavor of the fruit is preserved to a remarkable degree.

Canned figs for table use are graded in three sizes, blanched in hot water and packed in cans by hand. Hot syrup is added, and the filled cans are then exhausted, sealed and processed in boiling water. Fruit that is sound but over-ripe or mechanically damaged is cooked in kettles without syrup and packed solid in cans for the manufacture of preserves and pies.

Fruit Salad

This canned product is filling a need for a ready-prepared salad and fruit dessert. As packed on the Pacific Coast, five fruits are used, viz., peaches, pears, pineapples, apricots, and cherries prepared from white cherries and colored in Maraschino style. The fruit used is generally of Choice grade, though slight blemishes in the larger fruits are of no importance, as they are removed in trimming and slicing.

The fruit used for this product is usually packed in season in No. 10 cans and mixed as required. The cans are packed by hand and a syrup of about 30° Brix is added. The filled cans are exhausted, sealed and processed at 212° F.

Grapefruit

Canned grapefruit, a new product, has assumed considerable production proportions in Florida and Porto Rico. It supplies this popular fruit in a convenient form for breakfast service or for salads. The grapefruit is peeled by hand, and some canners are using a lye process (similar to that used for peaches) to remove the white inner layer that covers the fruit. The fruit is then thoroughly washed and the hearts or segments of fruit are separated from the protecting membrane and packed in cans by hand. Hot syrup is added, and the cans are exhausted, sealed and processed in hot-water tanks.

Olives, Ripe

Olives of the Mission and Manzanillo varieties are used largely in canning ripe olives in California and Arizona. In order to be sufficiently firm to withstand the treatment necessary before canning, the olives must

be picked as soon as ripe, but before they become soft and tender. They are first graded for size, eight sizes being commonly used. The olive naturally contains a high oil content, which distinguishes it from other fruits both in character and use as a food. It also contains a bitter principle, which must be removed to make it palatable, and for that purpose it is treated with a weak lye solution. The olives are then held in several changes of water till all lye is washed out. Then the olives are cured in brine of gradually increasing strength till 3 to 4 per cent brine has been reached. Gradual treatment is necessary to preserve the original form of the olives and to avoid shriveling. The olives are then packed in glass or tin containers of various special sizes and processed under pressure.

The ripe olive industry of California is now operating under special regulation by the State Board of Health. All canners of olives are obliged to take out licenses and a system of thorough inspection and control is provided from the raw materials to the finished product.

Peaches

The output of canned peaches in this country exceeds that of any other fruit, canning being done chiefly in California, Michigan and New York. The varieties of peaches used for canning differ markedly; in the East, the Freestone varieties are the most common, while Clings are largely used in the West.

The method of grading peaches has already been described in connection with the subject of quality and grades. Great care is taken to prevent bruising the fruit in picking it and hauling it to the cannery, and to get it into the cans as promptly as possible.

The first step in the cannery is that of halving, pitting and trimming, which is done by hand by the use of special knives for each operation. Machines for splitting both the fruit and pit have been tried out experimentally. Peaches are now usually peeled by the lye process, which is entirely a mechanical one. The pitted fruit is either sprayed or immersed for one-half to one minute in hot lye, which completely removes the skin without injuring the fruit. All the lye is removed from the fruit immediately afterward by thoroughly washing it under sprays or in running water. Should any trace of lye be left after this washing, it would be neutralized by the acid of the fruit. Complete removal of the lye is necessary to prevent darkening of the fruit.

After passing the fruit on to sorting belts, where defective or improperly trimmed or peeled fruit is removed by hand-sorting, the peeled fruit is sorted for size by means of a grading machine, which consists simply of a series of sieves, with openings of standardized sizes. The smallest fruit is used in the lower grades (which have been described elsewhere),

and the larger sizes for Choice and Fancy grades. Some of the largest fruit is also used for preparing canned sliced peaches. Peaches are also canned whole in syrup.

The graded fruit is carried on conveyor belts, one or more lines for each grade, to the filling tables, where the fruit is again washed and then filled into cans by hand. A certain amount of sorting is also done at the filling tables to remove defective or improperly graded fruit.

The filled cans are next conveyed to the syruping machines, where syrup of various strengths or water is added, according to the grade of fruit desired. The cans are then exhausted, sealed and sterilized at a temperature of 212° F.

Pears

As a table fruit the Bartlett pear is preferred above all other varieties of pears, as its fine flavor is well preserved in canning. Pears of the Kieffer variety are also extensively canned.

On account of the irregular shape of pears and the ease with which they may be bruised and discolored, the canning operations require an unusual amount of hand labor. The fruit is hand picked and the peeling and coring are done by hand with special knives. Expert labor is necessary in order that the fruit may be well peeled, uniformly split and carefully cored. The fruit is graded at the time of picking and coring, and is kept submerged in water or weak brine after it is peeled, to keep discoloration at the minimum.

The pears must be filled into the cans by hand, as it is necessary to layer the larger sizes to obtain the proper fill. The Fancy and Extra-fancy grades call for six to twelve perfect pieces for a No. 2½ can. The lower grades, Choice, Standard, Second and Pie, call for a smaller, less perfect fruit in lighter syrup or water. The syrups used are 40°, 30°, 20°, 10°, respectively.

Pineapple

Pineapple canning is now largely restricted to the Hawaiian Islands, as canneries located at the source of fruit production are assured of prime material. On the Hawaiian Islands, canners aim to cut the fruit in as ripe a condition as possible and to get it into the cans within thirty-six hours.

The fruit is first trimmed, top and butt, and then run through a sizing and slicing machine, which cuts the fruit to slightly less than the diameter of the can and in cross-sections so that eight pieces will make the proper fill. The core is removed during the same operation. The slices are inspected as they pass along a belt to the filling tables. Those which are

perfect, with the eyes fully developed, of fine texture, and good color are classed as Extra grade; those having irregularities in color or slight defects in cutting become Standard; and torn or broken pieces become "broken slices." The rest of the peeled and cored fruit, too irregular for slices, is packed as crushed and grated pineapple. The pineapple, though naturally high in sugar, requires a heavy syrup for table use.

Plums and Prunes

Both the yellow and purple varieties of plums are canned fresh. In the first type are the greengage and yellow egg, and in the second are the Lombard, damson and Italian prune. The fruit is stemmed, washed and, in some cases, graded for size. It is then packed in cans by hand, hot syrup or water is added, and the cans are sealed and processed at 212° F.

Dried prunes are also canned to a considerable extent, either with or without syrup. As the cooking is done after they are sealed in the can, the flavor of the fruit is preserved to a remarkable extent.

SEA FOODS

Clams

The little neck or hard clam is canned to some extent on the New England Coast, the long neck or soft clam on the South Atlantic Coast, while the razor clam is the basis of the minced clam industry that has assumed considerable proportions on the North Pacific Coast. Clam bouillon or nectar and clam chowder are also well known canned products.

Clams for canning are washed and the shells are then opened by steaming or immersing them in hot water. The meats are separated from the shells and trimmed by hand by clipping off the necks or siphons. Razor clams, which are larger, are also split, trimmed and passed through a meat chopper. A measured quantity of clams is placed in each can, hot brine or juice from the steamed clams is added and the filled cans are exhausted, sealed and processed under pressure.

Crabs

The canning of the Pacific crab in Alaska and Washington has developed to a considerable industry within the last few years. The blue crab is also canned in a small way on the Virginia Coast.

After being washed the crabs are boiled or steamed. The edible portions are then separated from the shell and viscera and are packed with a little salt in parchment-lined cans, which are exhausted, sealed and processed under pressure.

Fish Flakes

This product has been canned on the New England Coast for many years, with fresh cod and haddock as the basis. The fish are dressed and cleaned and are then held in brine for a time, depending on the size of the fish. After this they are cooked in retorts with live steam till tender, when the bones are separated from the meat, which is packed by hand into cans. The cans are exhausted, sealed and processed under pressure.

Lobsters

On account of the comparative scarcity of lobsters and the great demand and high prices paid for them in the large city markets, they are no longer canned in the United States, the industry being carried on only in Canada and Newfoundland. The so-called "spiny lobster" or "rock lobster," a species of crawfish, is also canned in the South.

Oysters

Oysters were one of the first food products to be canned in this country, the industry having been started in Baltimore to develop a larger market for the famous Chesapeake Bay oyster. On account of great improvements in the handling and shipment of raw oysters in recent years, the demand for raw oysters largely absorbs the supply of Northern oysters and canning has chiefly been confined to the South Atlantic and Gulf Coasts.

Oyster canneries are located along the coast and receive their supplies by boat. The oysters are unloaded into cars of slatted ironwork construction, which are run into a steam chamber for a few minutes to kill the oysters and open the shells. The cars are then run out into the packing room, and when sufficiently cool the oysters are shelled by hand by use of special oyster knives. The oysters are washed thoroughly and packed into cans, brine is added, and the cans are sealed, processed under pressure and cooled promptly under water.

Salmon

The Pacific salmon is one of the most important marine foods produced on this continent, and the canning of salmon is carried on from the coast of Northern California to Bering Sea, Alaska.

Five varieties of salmon are canned, grading being done almost entirely by variety and color of the flesh. In the following list the different varieties are given in the commonly accepted order of quality. It will be noted that several names are given to each variety, the name depending on the district in which the fish are caught.

1. Red, Sockeye or Blueback
2. Chinook, King or Spring
3. Medium Red, Cohoe or Silverside
4. Humpback or Pink
5. Chum or Dog

The production of canned salmon depends on the run of fish and varies greatly from year to year. The fish are caught at the time they are returning to fresh water to spawn, and several ingenious devices are used to catch them commercially, including traps, purse seines, gill nets, fish wheels and trolling. The fish are unloaded from the boats at the cannery by means of conveyors, from which they are fed to the "iron chink," a machine that removes the heads, tails, fins and entrails.

They are then thoroughly cleaned and washed by hand and fed to the cutting machine, which cuts them crosswise into pieces of the right size to fit the cans. Nothing is packed in the cans with the salmon except salt, which is placed in the cans mechanically. The fish is packed in cans either by hand or by machinery. Hand labor is generally employed for filling flat and oval cans, while the tall can is filled mechanically. After inspection of the cans for proper fill, the covers are clamped on loosely, and the cans are exhausted, sealed and sterilized under pressure. Because of the oily nature of the fish, the cans are finally cleaned in a lye bath and rinsed, and when cold they are tested for leaks.

Sardines

Under the definition of the Bureau of Fisheries, any small fish of the herring family, properly prepared, are entitled to be called sardines. In Europe, the pilchard and sprat are canned as sardines, in Maine, the young herring, and in California, the Pacific sardine. Either a frying or smoking process is used for cooking and drying European sardines, while in this country only frying and steaming processes are employed for that purpose.

In Maine the sardines are caught principally in traps or weirs, heart-shaped enclosures erected in bays or coves. The fish are conveyed to the canneries in special sardine boats, from which they are carried by running water in sluices to the pickling tanks, where they are held for one or two hours in strong brine. They are next spread by machine on wire trays, or "flakes," and are then either cooked in steam chambers and dried in drying rooms, or are first dried and then fried in oil. After cooling somewhat, the fish are packed by hand in cans, oil is mechanically added and the cans are sealed and processed.

In California the packing of sardines is closely connected with the

canning of tuna, and only when the latter are scarce do the canners devote themselves to sardine canning. Though small California sardines of fancy quality are put up to some extent by frying and packing in oil, a majority of the fish are of larger size and are packed in oval cans in tomato sauce. The larger fish are first sealed in a revolving perforated drum provided with water sprays, then beheaded and eviscerated. After being held in brine till they are firm and of proper flavor, the fish are dried, fried and packed in cans by hand. Sauce is added, and the cans are exhausted, sealed and sterilized under pressure.

Shrimp

The canning of shrimp is carried on in the South Atlantic and Gulf states, where two styles of pack are put up—the "wet pack" and the "dry pack." Larger shrimp are preferred for canning purposes. They are brought to the cannery in ice or are iced immediately on arrival. When canning begins, the shrimp are peeled, that is, the head and shell are removed by hand. The peeled shrimp are then thoroughly washed in fresh water and cooked or blanched by immersion in boiling brine. After the shrimp have cooled and drained, they are inspected to insure thorough peeling and are packed into parchment lined cans to prevent discoloration. For "wet pack" shrimp, some brine is added. The cans are sealed and processed under pressure, and promptly cooled under water.

Tuna

Tuna is canned in southern California, four varieties being used. The season usually extends from June to September, and various methods are used for catching the different varieties. Hook and line are used for albacore and striped tuna, and purse seines for the blue-fin and yellow-fin tuna.

The fish are cleaned and washed before being delivered to the canneries, into which they are carried on conveyors. Along these conveyors are sprays of water which wash the fish a second time. Then they are placed on racks and run into steam chambers, where they are cooked for two to four hours. When thoroughly cooled, the fish are skinned and the flesh is easily separated by hand into four longitudinal sections, two of dark and two of white meat. Both dark and white meat are canned, but the white meat is in much greater demand, probably for the same reason that white meat of chicken is more popular than dark meat. After the meat is cut into proper lengths it is packed in cans, and salt and vegetable oil (usually cottonseed) are added. The cans are then exhausted, sealed and processed under pressure.

California tuna is also put up Italian style, that is, more heavily salted and packed in olive oil.

MEATS

Canners of meats and canned meat products, being engaged in interstate business, operate under the Federal Meat Inspection Service. This inspection covers examination not only of the animals before and after slaughter, but also of the portions used in canning, other ingredients, and the method of labeling. Rigid sanitary requirements are enforced by the inspectors.

Such a large variety of meat products are canned that it is impracticable to describe in detail the methods used. In general, all meat for canning is carefully trimmed and freed from bone and other inedible portions. It is then given a preliminary cooking, and is either cut up in pieces to fit the cans or ground or chopped up and mixed with other ingredients to produce such products as potted meats, sausage and hash.

After the cans are filled, stock produced in cooking the meat is added to certain products and the cans are exhausted, sealed and sterilized in retorts under pressure.

In the case of some products packed in glass, the jars are sealed in a vacuum chamber and the exhaust treatment is omitted.

MILK

In the early days of the industry, the canned milk output was confined to the sweetened product, which depends for its preservation on the addition of a large amount of cane sugar in the condensing process. Since that time the canning of unsweetened evaporated milk has grown to a very large industry, and mechanical equipment has been developed for every stage of the process.

Sweetened condensed milk is milk from which a large part of the water has been removed by heating it in vacuum pans, and to which a considerable proportion of cane sugar has been added. Cane sugar, in the proportion present in the finished product, acts as an efficient preservative.

The government standard for sweetened condensed milk requires a minimum of 28 per cent milk solids and 8 per cent milk fat, and for the unsweetened product not less than 25.5 per cent milk solids and 7.8 per cent milk fat.

Milk for canning is subjected to constant supervision when delivered at the cannery, to ensure cleanliness, freshness and proper fat content. Before being tested, it is strained, weighed and mixed in large glass lined tanks, and if found acceptable, it is drawn off into heating tanks for pre-

heating. It is then pumped into vacuum pans or evaporators, heated by closed steam coils, where the milk is concentrated to the desired degree, which is checked by test samples. From the vacuum pans the milk passes to the coolers—a set of horizontal pipes through which cold water circulates and over which the milk flows in a thin layer. The cold milk then passes through a homogenizer, to reduce the size of the milk fat globules and to prevent separation of the fat in the cans. It is held in large glass-lined storage tanks from which it is delivered to mechanical can fillers. After being filled, the cans are sealed and, in case of unsweetened milk, are processed under pressure.

SOUPS

Because of their quality and convenience, the production and consumption of canned soups has increased very rapidly. Two classes of soup are made—light and condensed. Light soups can be served without the addition of water or milk and include chiefly beef, mutton, veal, chicken and clam broth and bouillon. They are usually packed in 8, 13, 32 ounce and No. 10 cans.

Condensed soups require the addition of an equal volume of water or milk. Among these are: asparagus, beef, bouillon, julienne, mock turtle, mulligatawny, mutton, ox tail, celery, consomme, chicken, pea, pepper pot, printanier, tomato, tomato-okra, chicken gumbo, clam bouillon, clam chowder, and vegetable. Condensed soups are usually packed in No. 1 cans, although beef, clam chowder, mutton, ox tail, tomato and vermicelli soups are also packed in No. 10 cans.

Vegetable soups, such as asparagus, celery, pea, and tomato soups, are packed during the season when fresh vegetables are available. The packing of others that require meats and materials available throughout the year is not restricted to any one period. Federal laws require the inspection of meat and meat products, and as many soups contain considerable meat stock, the production of these is under government inspection.

SPECIALTIES

Chili Con Carne

This Mexican dish ~~has~~ attained considerable popularity in the Southern states, and quite recently the canning of the product has been taken up to some extent. Being a meat product, it is subject to Government supervision.

The red beans and chopped beef are cooked and mechanically filled into cans and a special sauce containing Mexican chilis and other seasoning is added. The cans are sealed and processed under pressure.

Tamales

This is another popular Mexican dish which is now being canned in the Southwest. It consists of cooked meat, usually chicken or beef, enclosed in corn meal, which has been cooked up with the meat stock.

Other Specialties

A number of other specialties, such as plum pudding, brown bread, whole wheat, chicken a la king and lobster a la Newburg, are put up to a limited extent.

STORAGE AND CARE OF CANNED FOODS

Many kinds of canned foods will keep for years without appreciable deterioration, if stored in a cool, dry place. Some foods, particularly acid products, slowly attack the tin container and gradually suffer a loss of color and flavor. The higher the temperature of storage, the more rapidly such action takes place. In such acid foods the action of the acid on the tin plate may cause a leak in the can or gradual development of sufficient gas to cause bulging of the ends of the cans, even though the contents remain sound. The presence of air or other oxidizing substances in the can hastens such action and recent improvements in the methods of packing these products, such as a more thorough "exhausting" or driving out of the air and better sealing, are greatly reducing the amount of trouble of this kind. However, it is well to recognize that such products are somewhat perishable and should be treated accordingly.

Rusting can be prevented by storing canned foods in a place that is not damp and where the temperature is not subject to frequent and wide fluctuations. If the cans are colder than the surrounding atmosphere and the latter is heavily charged with moisture, water will condense on the surface of the can and rust spots may start that will gradually corrode through the tin plate until the can is perforated. If cans must be stored in a cellar that is not dry, it is best not to place them directly on the floor but a few inches above it.

While freezing does not affect the wholesomeness of canned foods, it injures the appearance and flavor of some foods. Frequent freezing and thawing are much more injurious to the appearance of the foods than allowing them to remain frozen continuously. Overheating in storage is also bad, and is particularly injurious to foods of an acid character, like fruits, for reasons above stated.

In short, stocks of canned foods should be kept only in dry storerooms or cupboards, where the temperature is fairly uniform and, if possible,

not over 70° F., preferably lower. Exposure of canned foods to freezing temperatures should also be avoided.

DRYING OF VEGETABLES

Dehydrated vegetables have been manufactured for many decades. Agricultural experimental stations here, and abroad, have been constantly developing and improving methods of dehydration. One of the principal causes for lack of consumer interest in past years has been the failure of the manufacturer to produce a dehydrated vegetable that was palatable and tender after being reconditioned. Proper methods of preparation for drying of vegetables are much better understood today. The consumer market has responded favorably to the improved taste and appearance of dry vegetables and, with further improvements in sight, it may now only be a question of time until these products are accepted as readily as fresh vegetables.

Vegetables that are dried in hot steam chambers or dry heat equipment are in most cases superior to those dried by means of the sun. However, fruits dried in the sun are just as palatable and suitable for cooking as the mechanically dried product. In selecting vegetables for drying purposes they should be chosen as fresh as possible, at optimum maturity, and be dehydrated on the same day. Over-ripe peas, sweet corn, celery, string beans, lima beans and leafy vegetables should be avoided, and sweet peas rather than the starch varieties should be utilized.

Vegetables should be thoroughly washed before trimming, to remove sand and insects, especially root vegetables, such as potatoes, beets, etc. The peeling of root vegetables may be accomplished by a violent rubbing action inside a rotating drum, carrying oyster shells or similar abrasive material. (The inside of this rotating drum should contain mechanical water spraying equipment.) After the vegetables have been washed, they should be blanched at 190 to 212° F. in hot water, to prevent the dry products from acquiring a hay-like odor becoming tougher on standing in storage, and darkening. (Blanching destroys the enzymes which causes darkening.) The trays should be constructed of such a size to be convenient for the workman to carry around. The dehydraters should be constructed by experienced engineers since temperature control, flow of air and venting must be carefully adjusted. For most vegetables, the drying temperature should not exceed 200° F., and the final moisture content in no cases should exceed 10%, while 5 to 6% is preferred from the standpoint of stability and retention of flavor during storage periods. All dry vegetables should be stored in a room that can be fumigated

and every known precaution exercised to prevent insect infestation. Cold storage at 32° F. or less is a guard against insect injury during storage.

A large business has developed in the sale of soup mixtures, usually prepared of root vegetables which have been diced to small size. Potatoes, turnips, onions, flaked, pre-cooked white dried beans, carrots, peas, celery, are a few of the many recommended ingredients that can be employed in the making of these mixtures.

SULFURING OF FRUITS

The sulfuring of fruits has been practised since ancient times. The active compound employed is sulfur dioxide generated by burning sulfur in the presence of water. Fruits are treated with sulfur dioxide for the purpose of preserving color, flavor, nutritive values, to prevent enzymic action oxidation, and to repel insect infestation during drying and storage.

When sulfur burns in the air it combines with oxygen to form sulfur dioxide, which in a pure state is a colorless gas but reacts with water to form sulfurous acid.

$$\underset{\text{(Sulfur)}}{S} + \underset{\text{(Oxygen)}}{O_2} = \underset{\text{(Sulfur dioxide)}}{SO_2}$$

The sulfur dioxide being soluble in water or fruit juice, forms sulfurous acid.

$$\underset{\text{(Sulfur Dioxide)}}{SO_2} + \underset{\text{(Water)}}{H_2O} = \underset{\text{(Sulfurous Acid)}}{H_2SO_3}$$

Sulfurous acid (often referred to merely as sulfur dioxide) is used as a preservative in a variety of foods. In this country the food manufacturer is allowed 350 parts per million (.035%) of sulfur dioxide in the finished food product. This is the amount tolerated by the Federal government in interstate commerce. While practically all states allow this same percentage, there are notably a few exceptions where no sulfur dioxide is permissable in most foodstuffs. The purpose of using sulfur dioxide at all is to prevent foods from fermenting or spoiling (both in liquid or dried fruit form); for example, if dried fruit were stored without sulfur dioxide in it, it would lose color, flavor and become infested with insects faster than if it contained the preservative. The amount of sulfur dioxide which should be incorporated in the fruit, so that it will be preserved, varies with the particular fruit; for example, apricots, peaches, nectarines, should have at least 2000 parts per million, pears 1000, bleached raisins 800, apples 1,500, cherries in sulfur brine 3000, grapefruit peel (either diced pieces or halves) 1,500, figs 1,500, orange and

Vegetable	Form for Drying	Blanching	Maximum Drying Temperature	Approximate Yield in lbs. of Dry Product per 100 lbs. of Fresh: From Prepared	Approximate Yield in lbs. of Dry Product per 100 lbs. of Fresh: Unprepared as Received
Green beans (string)	¾ to 1 inch lengths	Steam 15–20 minutes	155° F.	10–13	8–12
Beans, lima	Shelled beans, green	Steam 10 minutes	155° F.	No data	No data
Carrots & parsnips	Sliced or diced	Steam 5–15 minutes	160° F.	11–14	8–12
Celery	Sliced thin; or ½ inch lengths	Steam 1–3 minutes	145° F.	6–9	4–8
Cabbage	Trimmed, shredded as for kraut	Steam 2–6 minutes	150° F.	8–12	6–10
Corn	Pre-cooked on cob. Cut from cob	Steamed 15–20 minutes before cutting from cob	160° F.	25–28	8–12
Onions	Sliced or shredded	Steamed 1–2 minutes	140° F.	12–15	10–14
Garlic	Peeled. Sliced	Untreated; or 1–2 minutes in steam	150° F.	No data	No data
Peas	Shelled. Cleaned. Sorted	Steam 3–10 minutes	150° F.	18–22	9–14
* Potatoes, white	Peeled. Sliced or diced	Steam 5–7 minutes	150° F.	22–25	17–21
* Potatoes, sweet	Peeled. Sliced or diced	Steam 6–8 minutes	160° F.	32–35	24–28
Pumpkin	Peeled. Cut in slices	Steam 3–8 minutes	155° F.	7–9	4–8
Boston marrow squash	Peeled. Cut in slices	Steam 3–8 minutes	155° F.	11–14	7–11
Summer squash	Peel if rind thick. Slice	Steam 2–5 minutes	150° F.	No data	No data
Tomatoes	Scald. Peel, slice. Oil the trays with slab oil	No treatment. Or steam 2–3 minutes	150° F.	5–8	3–7
Turnips	Peeled. Sliced or diced	Steam 3–10 minutes	155° F.	10–12	7–10
Cauliflower	"Flowers" broken apart and sliced in half	Steam 5–10 minutes	140° F.	No data	No data
Spinach	Trim. Wash vigorously until free of sand	Steam 3–5 minutes	150° F.	7–11	3–6
Sprouts	Washed. Cut in half	Steam 5–8 minutes	150° F.	No data	No data

* **Note**: White potatoes are often pre-cooked after peeling and riced; they then need no further blanch. •Sweet potatoes may be pre-cooked before peeling; the peeling is then removed by hand and the potatoes sliced for drying.

lemon halves 1,500, Cuban, Porto Rican, and Singapore pineapple 2000 parts per million.

The method of sulfuring fruits consists simply of exposing them, in trays in a closed chamber, to an atmosphere of burning sulfur. For fruits packed in a brine (e.g., cherries, peels, pineapples, etc.), the sulfurous acid is added directly in a calculated amount to the barrel of fruit. There are any number of methods and procedures employed in sulfuring fruits, depending upon the operating conditions and the part of the country in which the preservative is employed.

When fruits are exposed to the fumes of burning sulfur the absorption of sulfur dioxide is great. However, a considerable proportion of the gas escapes during the first four hours in drying of this fruit. It is important to dry sulfured fruit rapidly, so as to retain the maximum amount of sulfur dioxide; one way to insure this is to use dry heat in the process of driving off the moisture.

The sulfuring of fruits has played an important part in balancing demand and supply, and in stabilizing prices during those months when the fresh fruit is unobtainable. The law with regard to the permissable amount of sulfur dioxide in the finished fruit preparations is constantly being enforced. This places a responsibility upon the food manufacturer for removing the greater part of sulfur dioxide present in the fruit when it arrives at the factory. It is not an uncommon procedure for a food manufacturer, in order to remove the sulfur dioxide, to allow sulfured fruits to remain submerged in water overnight, and then let the wash water run down the sewer. When this procedure is followed, almost 10% of the fruit itself is dissolved out and lost. In manufacturing preparations containing sulfured fruits, softening of the fruit, either by soaking or steaming in a large volume of water, to remove the excess of sulfur dioxide is recommended.

SOLUTION OF SULFUR DIOXIDE IN WATER (SCOTT) 15° C.

Percent SO_2 by weight	Bé. Degrees	Specific Gravity
.1	.07	1.0004
.2	.14	1.0008
.3	.21	1.0012
.4	.28	1.0016
.5	.36	1.0020
.6	.43	1.0024
.7	.50	1.0028
.8	.57	1.0032
.9	.64	1.0036
1.0	.72	1.0040
1.5	1.09	1.0070
2.0	1.46	1.0100
2.5	1.82	1.0125
3.0	2.19	1.0150
3.5	2.55	1.0180
4.0	3.07	1.0210
4.5	3.44	1.0235
5.0	3.80	1.0260
5.5	4.17	1.0285
6.0	4.53	1.0310
6.5	4.90	1.0335
7.0	5.27	1.0360
7.5	5.63	1.0385
8.0	5.99	1.0410
8.5	6.36	1.0435
9.0	6.73	1.0460
9.5	7.10	1.0485
10.0	7.46	1.0510

pH of SO_2 SOLUTIONS
as determined by
LA MOTTE CHEMICAL PRODUCTS CO.
BALTIMORE, MD.

Molar Strength	% Strength	pH
1.00	6.41	1.05
0.50	3.20	1.10
0.33	2.14	1.20
0.25	1.60	1.28
0.20	1.28	1.32
0.10	0.64	1.47
0.05	0.32	1.62

SODIUM BISULPHITE
SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS
AT 15° C.

Specific Gravity	Degrees Baumé	$\%NaHSO_3$	$\%SO_2$
1.008	1	1.6	0.96
1.022	3	2.1	1.3
1.038	5	3.6	2.2
1.052	7	5.1	3.1
1.068	9	6.5	3.9
1.084	11	8.0	4.8
1.100	13	9.5	5.7
1.116	15	11.2	6.8
1.134	17	12.8	7.8
1.152	19	14.6	9.0
1.171	21	16.5	10.2
1.190	23	18.5	11.5
1.210	25	20.9	12.9
1.230	27	23.5	14.5
1.252	29	25.9	15.9
1.275	31	28.9	17.8
1.298	33	31.7	19.6
1.321	35	34.7	22.5
1.345	37	38.0	23.6

CHAPTER XIII

JELLIES, PRESERVES, BRINING OF CHERRIES, CITRON, WATERMELON, LEMON, ORANGE, GRAPEFRUIT PEEL, MARASCHINO CHERRIES, CANDIED AND GLACE FRUITS

JELLIES, PRESERVES, JAMS, AND MARMALADES

Fruit jelly is a transparent or translucent substance, which while warm is fluid or semifluid, but becomes stiff on cooling. The jelly owes its flavor, color, and taste to the juice of the fruit and cane sugar. The property of forming the gel is due to the pectin derived from the fruit. The pectin percentage in fruit is highest just before the fruit becomes fully ripe. When equal quantities of fruit juice and sugar are heated together, the pectin gelatinizes the mass on cooling.

Pure fruit jellies usually contain 65% or more of soluble solids. The United States Department of Agriculture, Food and Drug Administration, defines fruit jelly as follows: The semisolid, gelatinous product made by concentrating to a suitable consistency the strained juice or the strained water extract from fresh fruit, from cold pack fruit, from canned fruit, or from a mixture of two or of all of these, with sugar or with sugar and dextrose.

It is impossible to give the exact amount of pectin and fruit acid needed in making jellies, inasmuch as the quality of the natural pectin and natural acid of the fruit varies so widely. Use more or less pectin, depending upon the natural jell strength of the fruit juice. The same also holds true for the acid.

DIRECTIONS

Use the juice made from fresh apples or fruits, and if not perfectly clear, filter through felt filters, a wine press, or through a hydraulic press.

Cane Sugar	50 lb.
Fruit Juice	50 lb.
No. 100 Powdered Pectin	2 oz. to 8 oz. (or about 50 oz. Liquid Pectin *)
Powdered Citric Acid	1 oz. to 2.8 oz.

* A method for making this concentrated liquid pectin is described further ahead.

Add fruit juice to kettle and, while bringing it to a boil, add 45 pounds of sugar with stirring. Mix the powdered pectin with the other 5 pounds of sugar in a dry pan, then slowly add the pectin-sugar mixture to the kettle. Stir the boiling contents until the pectin mixture becomes uniformly distributed. Now boil continuously and rapidly until a sample jells, normally at around 217°-222° F. Judge the finish by its drop from the paddle. First it will run, then string, next break from the paddle in sheets.

Dissolve the acid in about 4 ounces of warm water and add to the batch just before pouring the jelly into glasses or containers. Do not make too large batches of pure jelly at one time for pouring into glasses, because some pure fruit jellies like currant may start setting in the kettle if not removed quickly.

For barrel and pail jellies more pectin and acid will have to be used, according to the consistency wanted. Cook fruit juice, sugar, and pectin up to around 220° to 223° F., depending upon heaviness of product desired. Now let the batch in the kettle cool down to about 150° F. Some copper kettles are constructed with cold water inlets and outlets, especially for the purpose of rapidly cooling off the product. The barrel is now filled with 50 gallons of jelly. The calculated amount of liquid acid is added quickly to the barrel, stirring it in vigorously with a garden-type hoe, the blade itself having two large holes in it. Just as soon as the jelly grabs or sets, quickly remove the hoe. Jelly made this way should age for two or three days before shipment. For a 30-pound pail of jelly the required amount of liquid acid is added to the pail. The cooled off jelly in the kettle is then allowed to run quickly into the pails. The jelly should grab or set within several minutes.

MANUFACTURE OF LIQUID PECTIN

Dried Apple Skins or Apple Pomace	200 lb.
Water	250 gal.

Add water to a 350-gallon wood tank with cover. Bring water to a boil. Add the dried skins. Now boil vigorously, having live steam come through several perforated pipes extending up and down the tank. Allow to boil for about 40 minutes. The cooked batch is now run onto the hydraulic press, and the liquid collected. Approximately 180 to 190 gallons of liquid pectin juice results from the above formula. It may read from 3° to 4° Brix. Concentrate this juice in the kettle to 9°–10° Brix. This is now the liquid pectin product to be used in all jelly, jam, and preserves formulae as outlined in this book.

LOW COST SUGAR-FRUIT-PECTIN JELLIES

APPLE-RASPBERRY JELLY

Liquid Pectin	50 gal.
Cane Sugar	600 lb.
Red Raspberry Juice	4 gal.
Black Raspberry Juice	5 gal.

Add to the kettle the 50 gallons of pectin juice and the 600 pounds of sugar. Cook with stirring to 219° F., or if a heavier product is desired cook even to a higher temperature. Close the steam valve and now add the 9 gallons of fruit juices. Mix the contents. Allow the jelly to cool down to around 150° F. Pour the required amount of liquid acid into 30-pound pails, and then let the jelly run in quickly.

ACID COAGULANT FOR ALL JELLIES EXCEPTING IMITATION JELLIES

Tartaric Acid	48 oz.
Citric Acid	16 oz.
Enough water to make a total of 1 gal. acid solution	

Use 2 to 4 ounces of this prepared liquid acid for each 30-pound pail of jelly. If jelly is too firm or leathery use less acid. If jelly is not firm enough use more acid, provided you do not make the jelly too tart.

APPLE-RASPBERRY JELLY

Liquid Pectin	45 gal.
Cane Sugar	375 lb.
True Fruit Raspberry Flavor	6 oz.
Red Raspberry Juice	4 gal.
Black Raspberry Juice	4 gal.

This jelly is to be made in the same way as described for Apple-Raspberry.

RASPBERRY-PECTIN JELLY

Water	30 gal.
No. 100 Powdered Pectin (Use 20 lb. Sugar to mix it with)	5 lb.
Cane Sugar	260 lb.
Corn Syrup	140 lb.
Amaranth Color (4 oz. color dissolved in 1 gal. water)	12 oz.
True Fruit Raspberry Flavor	20 oz.

Place water in kettle and bring to a boil. Now add gradually the pectin-sugar mixture with stirring until the solution is complete. Add

the balance of the sugar and cook to 214° F. Now add the corn syrup and the color, and cook to 220° F. Close the steam valve and then add the flavor. Cool the jelly as recommended and then run into 30-pound pails, with the required amount of liquid acid already added. Use same acid solution as in apple-raspberry.

ORANGE-PECTIN JELLY

Water	15 gal.
No. 100 Powdered Pectin (Use 10 lb. Sugar to mix it with)	2 lb.
Cane Sugar	130 lb.
Corn Syrup	70 lb.
Egg Color Solution (3¾ oz. Tartrazine and ¼ oz. Orange I in 1 gal. water)	4 oz.
Orange Oil (Dissolved in 8 oz. Alcohol)	5 oz.

Make this orange-pectin jelly in the same manner as described for apple-raspberry.

PECTIN-SUGAR JELLY

Water or Fruit Juice or combination of both	60 lb.
Cane Sugar	100 lb.
No. 100 Powdered Pectin (Use 5 lb. of Sugar to mix it with)	1 lb.
Flavor	As desired
Color	As desired
Acid	¾ oz. Prepared Acid Solution

Bring water to boiling in kettle. Mix 1 pound of powdered pectin with 5 pounds of sugar and add slowly to boiling liquids (be it water or juice or both), stirring the added pectin until a uniform solution is obtained. Then the balance of 95 pounds of sugar is added to the kettle, stirred, and cooked up to not less than 217° F. and not higher than 221° F., depending upon how heavy the jelly should be. The steam is now turned off and the desired color and flavor are added. Cool the jelly down to around 150° F., and then run into 30-pound pails with the acid previously added to it.

The above formula represents a product known as pectin-fruit jellies. Flavor combinations like apple-currant, apple-strawberry, apple-raspberry, apple-grape, can be made as above described. Liquid pectin can also be used instead of the powdered pectin. Approximately 3 gallons of liquid pectin are equal to 10 to 16 ounces of No. 100 powdered pectin.

APPLE-MINT JELLY

Apple Juice	12 gal.
Cane Sugar	120 lb.
Liquid Pectin	4 gal.
Mint Flavor	1 oz.
Green Color	Enough to suit

Cook apple juice, sugar, and liquid pectin to 217°–219° F. Turn steam off, allow to cool off somewhat, and then add color and flavor. Add enough acid solution to glasses or other receptacles to make jelly set.

MINT FLAVOR

Oil of Spearmint	1 oz.
Oil of Peppermint	1 oz.
Alcohol enough to make	1 qt.

MINT COLOR

Tartrazine Food Color	¾ oz.
Guinea Green B Food Color	¼ oz.
Water enough to make	1 gal. Color Solution

DIRECTIONS FOR EXTRACTING FRUIT JUICES FOR JELLY MAKING

Heat, extractin, and filtration are essential steps in making fruit juices. The object of extracting the juice from the fruit is to obtain the pectin, natural coloring, acids, salts, and flavoring needed for jelly making. Firm fruits require longer cooking to soften the cellulose and to obtain a maximum yield of fruit juice, while soft fruits require short cooking.

Examine the fruits carefully, wash them, and remove decayed parts. Firm fruits may be cut into small pieces to allow for quicker softening while cooking and also to obtain a higher yield of juice. For firm fruits use around 1 pint of water for each pound of fruit. For grapes and berry fruits the water at first may be left out entirely and allow the fruit to be cooked up in its own juice. Too much water will give a thin juice and will therefore require later concentration. Too little water will give a cloudy juice, and it may also have the tendency of forming a jelly. Cooking of the fruit longer than is absolutely necessary results in loss of fruit flavor, darkening of color, extracting bitter substances, and destroying some of the pectin. The boiling time for apples is about 15–20 minutes, for citrus fruits about 1 hour, and for berries from 2 to 4 minutes.

The juice is separated from the pulp by straining through jelly bags, by pressing through a wine or hydraulic press, or by allowing the cooked batch to settle and pouring off the juice. A second and third extraction

may be made on some fruits such as apples, quinces, currants, grapes, raspberries, by cooking up the extracted pulp with more water.

In extracting the juice from grapes and berries, crush the fruit and then add 1 pound of water for about every 5 pounds of fruit. Heat fruit and water until tender, and then strain or press out the juice.

QUINCE JELLY

Quinces require long cooking to become tender. The quince flavor is exceptionally strong, and combining it with tart apples not only improves its flavor but also results in a jelly of better texture.

The quince is cut up into small pieces, sufficient water added, and cooked until tender. When the fruit is cooked tender drain off the juice and use it alone or combined with other fruit juices. Use about two-thirds as much sugar as fruit juice and make jelly in the usual manner.

LOGANBERRY OR GOOSEBERRY JELLY

Use sound, slightly underripe fruits. Examine fruit carefully, remove decayed parts. Wash the fruit. Add ½ pint of water for every 5 pounds of fruit. Heat the water and fruit slowly to the boiling point and boil for about 3 minutes. Drain the juice the best way, make a second extraction by covering the pulp with water and boiling for another 3 minutes. Combine the two extractions. Usually two-thirds as much sugar is requires as fruit juice in making this jelly.

BLUEBERRY JELLY

Add 1 pint of water for each quart of berries, bring to a boil and heat for 5 minutes. Drain the juice and then make a second extraction by covering the pulp with sufficient water and cook slowly for 10 minutes. Drain the juice and then combine the two extractions. Concentrate the combined juice by rapidly boiling to 1 pint for each original quart used.

CURRANT JELLY

Add 1 pint of water for each quart of fruit used. Boil slowly in covered kettle for 6–8 minutes. Strain and then return pulp to kettle. Add same amount of water, cover kettle and cook slowly for 10 minutes. Let stand 10 minutes, and strain. Combine the two extractions and concentrate by rapid boiling to receive 1 pint of juice for each quart of fruit originally used. Usually 1 pound of sugar to each pint of juice is used for making jelly.

APPLE JELLY

Wash and clean the fruit. Slice or cut into small pieces. Add 1 pint of water for each pound of fruit used. Boil in covered kettle for 15 minutes. Strain the juice. Return pulp to kettle and add same amount of water and cook slowly for 15 minutes. Strain. Combine the two extractions and concentrate by boiling so that 1 pint equals 1 pound of original fruit. Usually ¾ pound of sugar to 1 pint of apple juice will be found satisfactory for jelly making.

RASPBERRY JELLY

Wash and clean the fruit. Add 1 pint of water for each quart of fruit. Cover the kettle and boil for 5 minutes. Strain the juice. Return pulp to kettle and add same amount of water. Cook slowly for 10 minutes. Strain the juice. Combine the two extractions and then concentrate quickly by boiling to 1 pint for each quart of original fruit. Add ¾ pound of sugar for each pint of juice for jelly making.

GRAPE JELLY

Use firm ripe grapes. Add 1 pint of water for every 2 pounds of fruit. Remove stems, green, and decayed fruits. Boil slowly for 10 minutes. Strain the juice. Return pulp to kettle, cover with water, and cook slowly for 10 more minutes. Strain juice. Combine the two extractions and concentrate the juice so that 1 quart is the equivalent of 2 pounds of fruit. Use 1½ pounds of sugar for each quart of juice. Overripe grapes may be used if apple jelly stock is used measure for measure. In this 2 pounds of sugar for each quart of mixed fruit juice will make a satisfactory jelly.

STRAWBERRY JELLY

A satisfactory jelly can be made by taking a mixture of apple and strawberry juice. The strawberry is low in pectin and will not form a jelly. Apple jelly stock is made by taking equal parts of apples and water and cooking together until tender, and then straining the juice. The strawberries should be hulled, and decayed fruit removed. Cook berries slowly for about 5 minutes, using ½ pint of water for each quart of berries. Squeeze out all possible juice. To each pound of this juice add 1 pound of apple jelly stock, and then concentrate this combination to about 1½ pounds. Add ¾ pound of sugar per pint of concentrated juice for jelly making.

CHERRY JELLY

Cherry juice makes an excellent jelly when combined with an equal measure of apple jelly stock. Sweet as well as sour cherries can be used. The cherries are covered with water in kettle and heated to boiling and cooked until tender. The juice is then squeezed out. Concentrate the juice so that each pint is equal to 1 pound of original cherries.

CRANBERRY JELLY

Put 100 pounds of cranberries in kettle with 6 gallons of apple juice, bring to a boil, and cook 10 minutes. Express the juice and place in kettle with 50 pounds of sugar. Cook to 217° F. until jelly forms.

COMBINATION JELLIES

As seen from the above jelly formulas, some fruits will not make jellies unless mixed with apple jelly stock. These fruits contain insufficient pectin or acid to produce a good product. The raspberry, blueberry, blackberry, and grape will make jelly by themselves, but with the slight addition of apple juice they make even a better product. Half-grown, green apples always give best results, especially when mixed with the berry or grape juices.

BAKERS' QUICK FRUIT JELLY (UNSWEETENED)

Water	8 oz.
Agar-Agar	¼ oz.
Fruit Juice	16 oz.
Cane Sugar	¼ oz. (Or sweeter)

Mix the sugar and the agar well. Bring the water to a boil, add the sugar-agar mixture, and when dissolved remove from the fire. Add the fruit juice and when cooled to room temperature it will jell.

In the above formula any fruit juice can be used. Stewed fruits, berries also can be used to make a jam, or milk to make a custard.

PECTIN IN FRIUT

Most fruits are lacking in natural fruit pectin and fruit acid. Apples, grapes, lemons, currants are rich in pectin and acid, whereas strawberries, plums, raspberries, and apricots are average or poor. The following fruits are considered as having a high percentage of pectin:

Apples	Grapes	Oranges
Cranberries	Guavas	Pomegranates
Currants	Lemons	Quinces
Gooseberries	Limes	Tomatoes

Fruits having an average pectin content are as follows:

Apricots	Blueberries
Plums	Raspberries
Loganberries	Strawberries
Blackberries	

Fruits having a low pectin content are as follows:

Bananas	Pears
Cherries	Rhubarb
Pineapples	Figs
Peaches	

To be able to make commercial jellies or preserves or jams, pectin and acid must be added. Pectin is available either in powdered or liquid preparations. Powdered pectin is made from apples, or citrus peels.

PREPARATION OF LIQUID PECTIN FROM THE POWDERED PECTIN

A stock solution of liquid pectin can be easily made as follows:

No. 100 Powdered Pectin	1 lb.
Cane Sugar	5 lb.
Water	2 gal.

Mix the powdered pectin and the sugar in a dry pan. Add this mixture slowly and with stirring to the 2 gallons of boiling water. When solution is uniform shut off steam. Make final volume 2 gallons. One pint of liquid pectin is now equal to 1 ounce of powdered pectin.

A perfect jelly should be clear, transparent, should quiver, hold its form when cut, should be sufficiently firm and not mushy. It should not be syrupy, gummy, or sticky. To obtain satisfactory jelly the pectin, acid, and sugar must be adjusted in proper proportions. Varying proportions will naturally result in different jellies.

HELPFUL FACTS ON JELLY AND PRESERVE MANUFACTURE

1. Jelly forms best at a *p*H of 3.1 to 3.4. Above 3.4 the jelly has a tendency to form more slowly and sometimes not at all. Below 3.1 the jelly may be too acid and "weep" or "water out" (also called syneresis). Watering-out may happen due to lack of solids, poor pectin, or too much sugar.

2. Powdered pectin before use should always be mixed with cane sugar, and then added gradually to hot water. The less solids in this hot water

the easier it will be for the pectin to dissolve. Too much solids, like sugar syrup, may form lumps with the pectin.

3. Jellies and preserves should be cooked quickly and cooled quickly. This precaution will result in better taste, flavor, color, and texture.

4. Liquid pectin made from dried apple skins, pomacé, cores, pieces, chops, or wet apple skins is not to replace fruit juice in making pure jellies. It can be used for making imitation jellies, jams, or preserves. It can be used in pure jellies and preserves only where there is a natural deficiency of pectin in the fruit.

5. Juice extracted from berries, currants, and grapes averages 80 to 85% of the weight of the fruit taken. From solid fruits the average is 70%.

6. Elderberry, currant, loganberry, Columbian raspberry, and black raspberry juices are used to intensify color of jellies and preserves.

7. Too much pectin makes jelly leathery. Too much acid toughens the jelly and will carry more sugar as a result. But when carried too far, watering may take place due to hydrolysis of pectin by excess acid.

8. Pectin testing: To find out whether fruit-juice contains enough pectin, put equal parts of juice and alcohol in an evaporating dish. If the contents of pectin are sufficient for jelly making, the whole will settle to a gelatinous mass. If a loose, mushy mass forms, use less sugar than fruit by weight.

9. Jelly for glass goods is automatically filled from filling machines. If the jelly is filled while cold, it should be pasteurized at 180° F. for 30 minutes. If the jelly is filled while still hot, pasteurizing for 20 minutes is satisfactory.

METHOD FOR USING CLARASE * IN THE TREATMENT OF FRUIT JUICES TO PRODUCE SPARKLING AND PERMANENTLY CLEAR JELLIES

1. There is a growing demand for sparkling clear jellies, especially those produced from apples, quinces, and crab apples. The appeal to the purchaser is greatly enhanced and the manufacturer who produces these finer jellies will have an improved talking point for his salesmen and will obtain a larger share of the available business.

2. CLARASE is a dry powder which maintains its effectiveness for an indefinite period when kept properly closed against air and at a temperature not above 100° F. and not near steam pipes, heating units, etc.

* Takamine Laboratory, Inc., Clifton, N. J.

3. CLARASE is fully soluble in water and should be dissolved and then added to the liquid to be treated.

4. The CLARASE process of clarifying apple juice, quince juice, and crab apple juice, as well as similar juices high in starches, is as follows:

1. Maceration and cooking of the fruit;
2. Pressing the juice;
3. Cooling the juice to 85°–104° F.;
4. Adding CLARASE and "digesting" for one hour, more or less, as occasion may require;
5. Thoroughly filtering the juice through suitable filter;
6. Using the juice, canning the juice, or concentrating it as occasion may require.

THE PROCESS IN DETAIL

5. The amount of CLARASE to be used is proportionate to the amount of starches in the fruit juice. These starches vary considerably in different localities and depending upon the variety and ripeness of the fruit from which the juice is pressed.

6. It may be said, however, that on an average, from 6,000 to 8,000 parts of apple juice, quince, or crab apple juice (by weight) can be treated with one part of CLARASE (by weight).

7. The temperature of the treatment is very important as the juice is normally acid, and in an acid medium the temperature must be kept low to effect the most efficient results.

8. After the fruit is cooked and the juice pressed, it should be run through three or four sugar bags to remove as much of the suspended solids as possible; then cooled to the proper temperature of between 85°–104° F. either by natural cooling or by cold water or brine run through coils built into the tanks. After cooling, the juice is ready for the next step, namely, the treatment with CLARASE.

9. From the amount of juice to be treated, calculate the quantity of CLARASE required.

HOW TO DISSOLVE CLARASE

Weigh out the CLARASE in dry form and proceed to dissolve it in water of about 80° F. Pour just a little water at first on top of the dry CLARASE and stir into paste. Add a little more water until the CLARASE is thoroughly wet but still like a thick paste with no surplus water in the container. The very fine CLARASE powder would float on top of any surplus water and would be slow to dissolve, thus the addition of water must be done only in small amounts and slowly, mixing thoroughly all

the while to get all particles thoroughly wet, after which more water can be added and within a short time the material will all pass into solution.

10. Pour the water solution of CLARASE thus made into the fruit juice to be treated, which at this point must already have been cooled to between 85°–104° F., and stir thoroughly throughout the juice so that the enzyme is thoroughly dispersed. Note the time and digest for one hour. Take sample after one hour and test with iodine to note the starch color, which at this stage should begin to be quite brown or reddish brown, indicating the conversion of the starches into dextrines and maltose. If the iodine reaction still indicates the presence of undigested starch by a blue color, the reaction should be continued for a sufficient number of minutes to accomplish complete conversion, as indicated by reddish brown with iodine; otherwise it is an indication that more CLARASE should be used for the particular juice being treated. It is not unusual to make preliminary laboratory tests on a small scale for each batch of juice before digesting on a large scale. Such preliminary trials will indicate the exact amount of enzyme required in each instance.

11. The solution is now ready for final filtration and should be heated up to 160° F. or a little higher, as this stops the enzyme action and makes the filtering operation much easier. A successful type of filter frequently used is the plate filter using filter-cel as an aid to filtration. Care must be taken to avoid any of the cel passing through the filter with the juice.

12. The fruit juice so filtered is then ready for immediate use if desired to make up into jelly right away, or it may be placed in five-gallon cans and pasteurized for cold storage until needed, or it may be concentrated for future use, by evaporation.

13. No change is required in the method of using fruit juice that has been treated with CLARASE. The CLARASE treatment converts all colloidal starches into soluble sugars so that the undesirable effect of starch, in producing cloudiness in the finished jelly, is entirely eliminated. The conversion of the starch also frees any other colloids which may have been held together by the starches, so that all of these particles will be removed by the filtering operation, which is therefore much more effective. The resulting juice is brilliant in appearance and makes jelly which is correspondingly sparkling and maintains this property instead of becoming cloudy and dull as would otherwise be the case.

IMITATION JELLY

Imitation jelly can be made with corn syrup, cane sugar, artificial or genuine fruit flavors, coal tar certified food colors, liquid or powdered pectin, and with acids such as lactic, citric, tartaric, or phosphoric.

APPROXIMATE BASIC FORMULA

Concentrated Liquid Pectin (As described under manufacturing of liquid Pectin)	55 gal.
Corn Syrup, 42° Bé.	85 gal.
Red Color	3 pt.
Sodium Benzoate (Dissolved in a quart of warm water)	2 lb.
Acid	Sufficient to make jelly set
Flavor	As desired

MANUFACTURING DIRECTIONS

To the warm solution of pectin in the kettle, run in 85 gallons of corn syrup. Mix with an agitator. Now add color, flavor, sodium benzoate, and when thoroughly mixed, run into pails or barrels. The temperature of the batch should be around 150° F. If pail goods are desired (30 pounds of jelly to a pail) add to the pail 4 ounces of phosphoric acid solution and then fill with the jelly. In about 1 minute the jelly will set. If barrels are desired, first fill the barrel with the jelly, and then add the required amount of phosphoric acid, with vigorous up-and-down motion with a paddle. In about 1–2 minutes the jelly should be firm. If a barrel holds 51 gallons add 68 ounces of the prepared acid.

PREPARED PHOSPHORIC ACID SOLUTION

Phosphoric Acid (50%)	3 pt.
Water	2 pt.

Use 4 ounces of this solution to each 30 pounds of jelly. More or less may have to be used, depending upon the quality of pectin and sugar ratio.

PREPARED RED COLOR SOLUTION

Amaranth Certified Food Color	5 oz.
Ponceau 3R Certified Food Color	15 oz.
Water	5 gal.

Dissolve the color in the water.

The jelly pails should be closed the day following the filling. If jelly is low in solids it may ferment or develop surface molds.

GLUCOSE JELLY

Water	15 gal.
Corn Syrup, 42° Bé.	300 lb.
No. 100 Powdered Pectin	2¾ lb.
True Fruit Raspberry Flavor	10 oz.
Red Color (As prepared)	¾ pt.

Prepared Phosphoric Acid Solution to each 30-lb. pail	3–4	oz.
Sodium Benzoate (Dissolve in 1 pt. water)	5	oz.

DIRECTIONS

Mix the powdered pectin with about 10 pounds of sugar, and then add slowly to the boiling water with stirring. Now add the corn syrup and heat up to 221° F. Shut off steam and then add color, flavor, and sodium benzoate. Let the batch cool down to around 150°–175° F., and then fill into containers.

PRESERVES, JAMS, AND MARMALADES

The manufacture of preserves, jams, and marmalades is conducted on a large scale. The equipment consists of large, open, steam-jacketed copper kettles, lined with tin, or vacuum kettles. Sound fruit and sugar should be used, and foreign substances like corn syrup and food colors must not be used in making pure products.

Preserves and jams are made by cooking to a suitable consistency properly fresh fruit, cold pack fruit, canned fruit, or a mixture of two or all of these with sugar, or with sugar and dextrose, with or without water. In its preparation not less than 45 pounds of fruit are used to each 55 pounds of sugar or of sugar and dextrose. A product in which the fruit is whole or in relatively large pieces is customarily designated a "preserve," rather than a jam. This is the definition as given by the Department of Agriculture.

The name jam is generally applied to fruits preserved by cooking with sugar, without retaining the shape of the fruit.

A good jam or preserve is bright in color, may or may not have jelly-like consistency, and the flavor is characteristic of the fruit from which it is made. It should not be oversweet. Fruit and sugar are the essential ingredients necessary to make a jam or preserve but, if a jelly-like consistency and tartness are desired, both pectin and acid are used.

DIRECTIONS

Fruit and sugar should be weighed carefully and both heated in the kettle. Cooking should be rapid in order to retain maximum natural color, natural flavor and taste. When the batch begins to get heavy in the kettle while cooking, stir the contents to avoid side-burning. When the proper temperature has been reached, 220°–224° F., transfer contents immediately to cooling table, or pour into jars, seal them, turn them upside down

to sterilize covers. To thicken up the preserves or jams, either powdered or liquid pectin can be used.

HIGH QUALITY PURE PRESERVES

Fruit	50 lb.
Cane Sugar	50 lb.
No. 100 Powdered Pectin	3–4 oz. or 1 gal. Liquid Pectin
Fruit Acid Solution	2–4 fl. oz.
Water	3 gal.

Add to kettle 3 gallons of water, bring to a boil, add 45 pounds of sugar, and cook to 220° F. In a separate kettle cook up with ½ gallon of water a mixture of the powdered pectin and 5 pounds of sugar. Add this liquid pectin to the kettle containing the sugar. Also add the juice of the fruit and cook again to 220° F. Now add the fruit and acid and cook quickly to 221°–223° F., or until the product gives a good sheet test on the paddle or wide blade. Now transfer quickly to cooling table.

If the product does not sheet off the paddle at 223° F., it usually is an indication of insufficient pectin, and more should be added. Cooking above 223° F. in order to thicken the product may sometimes also result in the product crystallizing out, having an oversweet and carmalized taste.

When frozen or cold pack fruit, packed with sugar, is used, the amount of sugar and fruit in the above formula will vary as follows:

	2 Plus 1 Fruit	3 Plus 1 Fruit	4 Plus 1 Fruit
Use this amount sugar	25 Lbs.	33 Lbs.	37½ Lbs.
Use this amount cold pack fruit ...	75 Lbs.	67 Lbs.	62½ Lbs.

Allow fruit to thaw out completely before making preserves.

AVERAGE QUALITY PURE PRESERVES

Fruit	45 lb.
Cane Sugar	55 lb.
No. 100 Powdered Pectin	3–4 oz. or 1 gal. Liquid Pectin
Fruit Acid Solution	2–4 fl. oz.
Water	3 gal.

Make these preserves in the same way as above.

When frozen or cold pack fruit, packed with sugar, is used, the amount of sugar and fruit in the above formula will vary as follows:

	2 Plus 1	3 Plus 1	4 Plus 1 Sugar
Use this amount sugar.............	32½ Lbs.	40 Lbs.	44 Lbs.
Use this amount cold pack fruit....	67½ Lbs.	60 Lbs.	56 Lbs.

IMITATION JAMS OR PRESERVES

These products are deficient in fruit and therefore must be labeled as imitation. The percentage of ingredients should be declared on label.

No. 1

Fruit	35 lb.
Sugar	55 lb.
Liquid Pectin	3 gal.
Fruit Acid Solution	4–6 fl. oz.

No. 2

Fruit	25 lb.
Sugar	55 lb.
Liquid Pectin	4 gal.
Fruit Acid Solution	4–6 fl. oz.

No. 3

Fruit	15 lb.
Sugar	55 lb.
Liquid Pectin	5 gal.
Fruit Acid Solution	6–8 fl. oz.

With cold pack fruit, the above would be prepared as follows:

No. 1

52½ lb. 2 plus 1 Fruit and 37½ lb. Sugar
47 lb. 3 plus 1 Fruit and 43 lb. Sugar
44 lb. 4 plus 1 Fruit and 46 lb. Sugar

With cold pack fruit, the above would be prepared as follows:

No. 2

37½ lb. 2 plus 1 Fruit and 42½ lb. Sugar
33 lb. 3 plus 1 Fruit and 47 lb. Sugar
31 lb. 4 plus 1 Fruit and 49 lb. Sugar

With cold pack fruit, the above would be prepared as follows:

No. 3

22½ lb. 2 plus 1 Fruit and 47½ lb. Sugar
20 lb. 3 plus 1 Fruit and 50 lb. Sugar
19 lb. 4 plus 1 Fruit and 51 lb. Sugar

PREPARATION OF FROZEN FRUIT

The preserve industry uses quantities of cold pack or frozen fruits. This makes all-year manufacturing of preserves a reality. Fruit may be frozen with and without sugar. Berries used for frozen pack are completely ripened. They are washed and graded for size. Foreign matter and imperfect fruit are removed. Before freezing, berries and sugar should be mixed, and the sugar should also be in complete solution before freezing. The fruit in barrels is frozen quickly in order to retain the maximum color, flavor, and texture. It takes 2 to 3 days at 0° F. to complete the freezing operation. The barrels are then stored at 12°–15° F. until ready for shipment. Fruits are packed in the ratios of 2 parts fruit and 1 part sugar, 3 parts fruit and 1 part sugar, and 4 parts fruit and 1 part sugar, or all fruit without sugar.

The varieties of strawberry most used are the Marshall, Missionary, Blakemore, and Klondike. The bulk of raspberries used are Red Cuthberts and Black Columbians.

BLUEBERRY JAM

Blueberries	45 lb.
Cane Sugar	55 lb.

Cook the blueberries until soft, then put through strainer or pulper. Combine the pulp and sugar and boil the mixture until it is thick and clear.

APPLE-BLUEBERRY JAM

Blueberry Pulp	20 lb.
Tart apples, which have been peeled and cut	25 lb.
Cane Sugar	55 lb.
Grated Lemon Rind	4 oz.
Citric Acid	2 oz.

Combine the above mixture and cook up until thick and clear.

CHERRY PRESERVES

The cherries should be washed, stemmed, and pitted. Combine 45 pounds of the cherries with 55 pounds of sugar and cook together in kettle as directed under making of jam.

CURRANT JAM

Wash the currants and remove the stems. Combine 45 pounds of fruit with 55 pounds of cane sugar and cook together in kettle as directed under making of jam.

DAMSON PLUM JAM

Wash the plums, then cover with water in the kettle and cook the fruit until the skins are soft. Cool and then remove the pits in a pulper. The jam should be cooked up in the ratio of 45 pounds of fruit to 55 pounds of cane sugar, as directed under making of jam.

GRAPE JAM

The grapes should be washed and stemmed. Then press out the pulp from the skins. Now cook the pulp with the addition of about 10% water, and then press through sieves, or put through a pulper to remove the grape seeds. Add the skins to the pulp if desired and then take 45 pounds of pulp and 55 pounds of cane sugar and cook in kettle to proper consistency as described under making of jam.

APPLE-PEACH JAM

Peaches (Cut into small pieces)	20 lb.
Tart Apples (Cut into small pieces)	25 lb.
Cane Sugar	55 lb.

Boil the above mixture until it is thick and clear, following directions as given under making of jam.

PEACH-ORANGE-PINEAPPLE JAM

Peaches (Cut into small pieces)	30 lb.
Crushed Pineapple	10 lb.
Lemon Juice	2½ lb.
Orange Juice	2½ lb.
Cane Sugar	55 lb.
Grated Orange Rind	8 oz.
No. 100 Powdered Pectin	1–4 oz.

Combine the above mixture and cook together as directed under making of jam.

PEACH-ORANGE JAM

Crushed Peaches	40 lb.
Orange Juice	5 pt.
Lemon Juice	5 pt.
Grated Orange Rind	12 oz.
Cane Sugar	60 lb.
No. 100 Powdered Pectin	1–4 oz.

Combine all of the above ingredients and cook together in the kettle as directed under making of jam.

PLUM JAM

Plum Pulp and Juice	300 lb.
Pitted Prunes	100 lb.
Cane Sugar	275 lb.
Concentrated Liquid Pectin	20 gal. (Or 2¾ lb. No. 100 Powdered Pectin)
Citric Acid	1 lb.
Caramel or Sugar Coloring	3 lb.
Water	5 gal.

Bring the plum juice and water to a boil, and then add the cane sugar. While still boiling stir the sugar until dissolved, and then add the plum pulp and the prunes (which have been previously cooked until very soft and then put through the meat grinder, making it into a paste), and then add the concentrated liquid pectin. If powder is used, mix it at first with about five times its own weight in sugar. Now add the citric acid dissolved in water. Cook the contents in the kettle until the temperature reaches around 223° F. If the sheet test is satisfactory, add the caramel color, mix in thoroughly, and quickly transfer to the cooling table. If sheet test is poor, continue cooking to a higher temperature.

IMITATION RASPBERRY JAM

Formula No. 1

Raspberry Fruit and Juice	200 lb.
Cane Sugar	400 lb.
Concentrated Liquid Pectin	32 gal. (Or 4 lb. No. 100 Powdered Pectin)
Water	20 gal.
Citric Acid	2 lb.
Red Color	If desired

Bring the water to a boil and then add the sugar. Continue boiling until the temperature registers 220° F. Now add the pectin, continue boiling, and then add the raspberry fruit and juice. Then add the citric acid dissolved in about 1 pint of warm water. Continue the boiling until the temperature reaches about 223° F., or until the proper sheet test is had. Transfer quickly to cooling table.

IMITATION RASPBERRY JAM

Formula No. 2

Raspberry Fruit and Juice	110 lb.
Cane Sugar	200 lb.
Corn Syrup	75 lb.
Concentrated Liquid Pectin	15 gal. (Or 3 lb. No. 100 Powdered Pectin)
Citric Acid	¾ lb.
Red Color	If desired

The above imitation jam is made the same way as No. 1. The corn syrup is to be added after the cane sugar.

Imitation strawberry jam is made in the same way as described for imitation raspberry jam, excepting that strawberry fruit is used.

IMITATION APRICOT JAM

Apricot Pulp	120 lb.
Cane Sugar	250 lb.
Concentrated Liquid Pectin	7 gal. (Or 2½ lb. No. 100 Pectin)
Citric Acid	½ lb.
Water	15 gal.

The above apricot jam is made in the same way as described for imitation raspberry jam.

IMITATION APRICOT JAM

Evaporated Apricots	50 lb.
Cane Sugar	85 lb.
Concentrated Liquid Pectin	5 gal. (Or 12 oz. No. 100 Pectin)

Soak the fruit overnight in sufficient water, and in the morning put through the grinder. Add fruit and sugar to the kettle, and while boiling add the pectin. Cook up to around 224° F. or until the batch shows a good sheet test. Transfer immediately to the cooling table.

IMITATION PRUNE PASTE OR LEKVAR

Prunes *	250 lb.
Cane Sugar	100 lb.
Corn Syrup	200 lb.
Concentrated Liquid Pectin	10 gal. (Or 2 lb. No. 100 Pectin)
Sugar Coloring	4 pt.
Water	10 gal.
Citric Acid	8 oz.

* The prunes have pits in them and are rather tough. The pits must be removed and the flesh cooked until softened. The procedure is to allow the prunes to soak overnight just covered with water. In the morning transfer to kettle, add more water, bring to a boil and cook until the prunes are soft. Then put the prunes through the pulper, which removes the pits and pulps at the same time. Use this prune paste for the above.

Bring the water to a boil in the kettle and then add the sugar. Stir until dissolved, then add the corn syrup, liquid pectin, prunes, acid, and color. Cook to a pretty high temperature, of around 224°–228° F., or to the proper consistency desired. Transfer to cooling table.

ORANGE-PINEAPPLE JAM

Crushed Pineapple	400 lb.
Orange Peels *	90 lb.
Cane Sugar	500 lb.
Liquid Concentrated Pectin	15 gal. (Or 5 lb. No. 100 Pectin)
Citric Acid	1 lb.
Water	10 gal.

* The orange peel for this formula must be prepared as follows: Soak the fresh orange peel overnight. In the morning cook the peel in the kettle covered with sufficient water, and change the hot water at least three times to remove the bitterness, and also to render the peel soft and tender. Then put the peel through the grinder.

Bring water to boil in kettle and then add the crushed pineapple, sugar, orange peel, liquid pectin, and acid. Cook quickly to 223° F., or until proper sheet test. Then transfer to cooling table.

ORANGE FLAVORED PINEAPPLE JAM

Crushed Pineapple	450 lb.
Cane Sugar	300 lb.
Orange Oil (Dissolved in 16 oz. Alcohol)	12 oz.
Sodium Benzoate	10 oz.
Tartaric Acid	6 oz.
Orange Color	Enough to suit
Agar-agar *	1¼ lb.
Water	20 gal.

* Let the agar-agar soak overnight in 5 gallons of water. In the morning add it to the kettle, bring to a cook and then add the 25 pounds of cane sugar. Cook this mixture until the temperature registers 222° F. Use this mixture of agar and sugar and work into the pineapple batch on the cooling table.

Bring the water to a boil. Add 275 pounds of sugar and cook to 220° F. Then add the crushed pineapple and, while rapidly cooking the batch, add the sodium benzoate dissolved in a little water, and also the color and dissolved acid. Cook to 222°–224° F. Transfer to the cooling table, and while here work in the solution of agar-agar first into the batch until uniformly mixed. Then work the orange flavor into the batch on the cooling table.

ORANGE MARMALADE

Cane Sugar	100 lb.
Oranges (Use ¾ oranges and ¼ lemons)	50 lb.
No. 100 Pectin	6–8 oz. (Or 2 gal. Concentrated Liquid Pectin)
Water	5 gal.

Wash the fruit. Cut in half, remove juice with a reamer, and filter or strain the juice. Slice orange and lemon peel very thin, cook up with water in kettle until soft and tender. This may take as long as 1 hour. Mix the cooked peel with the strained juice, boil slowly, then sprinkle in slowly the pectin-sugar mixture, or the liquid pectin. Then add the balance of the sugar, and cook rapidly to 224° F. or until the proper sheet test.

ORANGE MARMALADE

Cane Sugar	67 lb.
Orange Pulp and Skins	33 lb.
No. 10 Powdered Pectin	4 oz.
Or	
Concentrated Liquid Pectin	100 oz.
Citric Acid	2 oz.

Mix together the 4 ounces of pectin and 1 pound of sugar. Cook together balance of sugar and pulp. Add pectin mixture or pectin solution. Stir, and cook quickly until batch sheets off paddle. Shut off steam. Add solution of citric acid. Transfer to cooling table.

GINGER PRESERVE

Drain the ginger well and then cut it up. Place in cold water in a steam pan, gently bringing to the boil and simmering for 20 minutes. Place in sieves in drain. Transfer to a cold syrup of 4 pounds of sugar to each gallon of water, and allow to stand until the next day. Transfer all to steam pan, gently bring to boil, and simmer for 15 minutes. Then place in a clean dry tub and allow to stand until the next day. Run off the syrup into the steam pan and add 3 pounds of sugar to each gallon of syrup. Stir well and bring to boil. Return this syrup to the ginger in the tub and allow to stand until the following day, then place in sieves to dry. Roll in sugar and shake out the loose sugar through a coarse sieve. Then spread out to dry.

KEEPING QUALITIES OF JAMS AND JELLIES

All jams in open packages, unless artificially preserved, should contain from 65 to 70% sugar in the finished product. In air-tight packages, which are given a special process, the product may be kept successfully with less sugar. The per cent of sugar in a jam or jelly may be readily calculated from the amount of sugar used and the amount of jam produced, allowing about 3% more for the sugar in the fruit and inversion of the cane sugar.

The most satisfactory package for jams and jellies is the air-tight

closure. Jams are best filled hot, sealed at a temperature of 170° F. or more, and inverted or rolled in such a way as to force the small amount of air in the jar through the hot mass. Another method is to fill hot, allow to cool, vacuumize the jar, and pasteurize at a low temperature.

Jellies are best filled hot, and sealed at a temperature not lower than 170° F. Or, they may be filled at lower temperatures, allowed to set, vacuumized, and then pasteurized.

Units of 60–80 pounds of jellies and 100–150 pounds of jams will give better products than larger amounts. The quicker the operation is finished and the preserve cooled off, the better is the flavor and color. The simplest cooler is a copper or plain wooden table about 8 feet long by 3 feet wide and 6 inches deep. This is placed on a slight incline and the jam being spread in a thin layer cools very quickly. The size and slope can be varied to deliver the jam into the filling receptacle at the required temperature.

Crystallization in jams can be prevented by regulating the amount of invert sugar present.

After boiling, the jam should be analyzed for invert sugar, and if the amount does not fall between the limits of 25 to 30%, either the acidity or the time of boiling should be adjusted so that more or less inversion takes place.

In soft fruits the finishing temperature is usually about 223°–224° F. For hard fruits the temperature is a little lower, about 220°–221° F.

CHEMICAL COMPOSITION OF FRUIT, JUICE, COLD PACK FRUIT, FRUIT JELLIES AND PRESERVES

In the manufacturing of jellies and preserves, either the fresh or frozen fruit may be used. The cold pack or frozen fruit may also be packed with added sugar. When 3 parts of strawberries are mixed with 1 part of sugar, and then frozen, full reliance is placed on the packer, as to the correct amounts used, etc. The chemical composition of the berry or the pack cannot be guaranteed and is generally not discussed by the merchant. The food chemist is able to determine only by chemical analyses the amount of fruit or fruit juices used in the manufacture of preserves or jellies.

The discussion of the composition of fruit juices, fruit jellies, or preserves in the following chapters may be accepted as authentic because a great deal of this work has been done in the author's laboratories. The analyses of these jellies and preserves represent pure products. However, it must be recognized that the chemical composition of fruit varies, depending upon the crop, soil, drought, fertilizer, and especially upon the

location from which it is derived. Therefore the composition of the finished product cannot always be the same.

COMPOSITION OF FRUITS *

Fruit	Total Solids	Water Insoluble Solids	Total Invert Sugar	Ash	Alcohol PPT	Pectic Acid	Acid as Citric	Malic Acid	Tartaric Acid
	%	%	%	%	%	%	%	%	%
Apple	17.25	2.50	11.50	.33	.76	.32	....	.57	
Apricots	16.50	1.79	8.50	.75	.80	.46	.50	.80	
Blackberries	15.57	7.23	7.00	.44	.62	.32	.96		
Black raspberries	20.00	9.00	6.50	.65	.65	.35	.95	.04	
Cherries	16.25	1.38	8.22	.49	.20	.10	....	.92	
Crab-apples	18.22	3.22	10.90	.41	1.25	.72	....	1.25	
Currants	16.00	5.85	6.20	.57	.68	.41	1.90	.08	
Cranberries	15.00	3.22	4.80	.28	.82	.52	1.25	.90	
Figs	21.00	3.22	15.25	.56	1.00	.68	.08	.15	
Gooseberries	12.00	3.00	4.50	.44	.72	.42	.50	1.50	
Grapes (Concord with lot of skins)	16.00	1.25	12.00	.48	.58	.32	....	.35	.87
Loganberries	15.54	6.07	3.68	.50	.72	.36	1.65	.15	
Peaches	13.50	1.65	9.00	.50	.98	.45	.20	.50	
Pineapples	15.60	1.10	12.50	.43	.10	.05	.73	.20	
Plums (Damson with practically all skin)	14.50	1.48	8.00	.43	1.22	.78	....	2.14	
Quinces	17.00	3.22	7.25	.46	1.00	.62	....	1.10	
Raspberries	14.00	6.00	4.32	.46	.78	.32	1.30	.05	
Strawberries	10.00	2.70	5.36	.47	.52	.33	.87	.20	

* Examined in author's laboratories, Shirley Laboratories, New York City, N. Y.

COMPOSITION OF FRUIT JUICES*

Fruit	Total Solids	Total Invert Sugar	Ash	Citric Acid	Malic Acid	Tartaric Acid	Protein
	%	%	%	%	%	%	%
Apple	12.98	11.32	.29	....	1.17	....	.10
Blackberries	15.60	8.40	.40	.92†	....	....	.38
Apricot	11.54	7.40	.51	....	.84	....	.51
Cherries	17.56	11.36	.48	....	.64	....	.48
Currant	11.55	6.90	.48	2.11	....	....	.34
Grape	16.80	14.50	.38	....	....	.98	.28
Grapefruit	12.17	6.40	.41	1.28	....	....	.32
Loganberry	11.00	6.50	.48	1.89	....	....	.60
Lemon	12.00	4.89	.28	6.50	....	....	.32
Quince	12.50	8.98	.49	....	1.20	....	.30
Orange	14.00	10.00	.46	1.35	....	....	.50
Peach	10.65	6.88	.46	....	.98	....	.41
Pineapple	17.00	11.45	.50	.70	....	....	.20
Raspberries	10.39	6.02	.45	1.67	....	....	.34
Black raspberries	12.17	7.51	.55	1.38	....	....	.36
Strawberries	7.71	4.70	.43	.71	....	....	.26

* By A. L. and Kate Barber Winton—Structure and Composition of Foods.
† Iso-Citric.

COMPOSITION OF COLD PACK FRUIT*

Fruit	Total Solids	Total Invert Sugar	Water Insoluble Solids	Ash	K_2O in Ash
	%	%	%	%	%
100% Strawberry	13.41	7.36	1.93	.33	38
100% Strawberry	15.67	9.82	3.35	.48	42
3 + 1 Strawberry	38.20	30.20	2.00	.33	32
2 + 1 Strawberry	40.52	37.10	2.70	.28	33
100% Raspberry	13.20	5.15	5.20	.38	42
100% Raspberry	14.57	5.36	8.82	.46	34
12% Added Sugar (To Raspberry)	27.82	17.92	6.16	.43	38
3 + 1 Raspberry	35.20	27.32	4.80	.31	30
100% Loganberry	12.54	3.68	6.07	.50	42
100% Blackberry	15.24	7.09	5.87	.42	38

* Examined in author's laboratories, Shirley Laboratories, New York City, N. Y.

PURE FRUIT JUICES *—ALKALINITY OF ASH AND PROTEIN CONTENT

Juices	Degrees Balling or Brix	Per Cent Ash Content in 100 gm			Alkalinity in Ash †			Acid Content Grams per 100 cc	Protein Per Cent
		Total Ash	Soluble Ash	Insoluble Ash	Total Alkalinity	Soluble Alkalinity	Insoluble Alkalinity		
1. Apple juice	15.95	.2999	.2356	.0639	30.7	27.3	3.4	.83	.15
2. Grapefruit juice	12.85	.3204	.2404	.0800	42.58	23.82	18.76	1.98	.32
3. Lemon juice	12.1	.2860	.2231	.0629	40.96	26.32	14.64	6.12	.32
4. Navel orange juice (late)	17.1	.4986	.3994	.0992	87.1	60.9	26.2	0.83	.65
5. Valencia orange juice	14.75	.5149	.4341	.0808	78.5	55.4	22.1	1.4	.58
6. Pineapple juice (canned)	17.7	.5080	.3593	.1487	40.9	34.2	6.7	1.07	.15
7. Grape juice (bottled Concord)	17.85	.2188	.1499	.0769	27.7	23.2	4.5	1.40	.25
8. Black cherry (California)	19.5	.5554	.3060	.2494	50.9	44.7	6.2	.96	1.1
9. Loganberry juice (early)	14.2	.3984	.2747	.1237	41.4	35.2	5.9	2.49	.85
10. Strawberry juice	14.15	.4874	.3421	.1453	26.4	23.1	3.3	1.12	.42
11. Raspberry juice	12.45	.5894	.4336	.1558	40.3	35.2	5.1	1.04	.46
12. Royal Anne cherry juice	20.1	.5101	.4094	.1007	50.2	44.5	6.2	.69	1.2
13. Navel orange juice	11.5	.328	.273	.055	83.7	56.8	26.9	1.19	....

* Alkalinity in ash cc N—10 HCl per 100 gram sample.
† H. Aref and W. V. Cruess, University of California, The Fruit Products Journal and Amer. Vinegar Ind.

COMPOSITION OF JELLIES *

Fruit	Total Solids	Total Invert Sugar	Ash	P_2O_5 in Ash	K_2O in Ash	Alk.† No. of Ash	Acid as Malic	Protein (N × 6.25)
	%	%	%	%	%	%	%	%
Apple	66.28	63.05	.18	9	35	10	.87	.06
	63.92	60.00	.15	7	32	8	.48	.02
Apple-currant	70.32	66.92	.20	8	38	11	.70	.18
	65.47	62.70	.17	10	36	12	.41	.12
Apple-raspberry	67.25	64.10	.20	8	30	10	.76	.18
	67.85	66.40	.16	9	34	9	.58	.10
Blackberry	72.07	67.72	.26	12	35	13	.62‡	.22
	64.15	61.82	.18	15	28	9	.50‡	.15
Apple-strawberry	67.85	64.22	.17	12	33	8	.68	.18
Apple-blackberry	69.20	66.82	.18	16	38	12	.72	.16
Apple-mint	65.40	64.10	.14	6	26	8	.52	.05
Currant	69.40	68.00	.24	16	42	16	.92‡	.20
	65.10	63.00	.19	12	36	10	.72‡	.16
Crab-apple	66.00	61.80	.20	9	38	14	.45	.12
Grape	67.60	65.60	.18	7	29	8	.50§	.22
	66.60	63.30	.15	11	32	7	.60§	.15
Plum	69.20	66.01	.24	9	42	11	.62	.20
Raspberry	66.10	62.32	.22	14	38	12	.86‡	.20
	67.22	64.00	.16	16	26	14	.42‡	.18
Strawberry	69.28	65.18	.23	12	38	16	.50‡	.12
	63.76	60.25	.18	18	33	12	.42‡	.15

* Examined in author's laboratories, Shirley Laboratories, New York City, N. Y.
† C. C. Normal Acid required to neutralize the alkalinity in 1 gram of ash.
‡ As Citric Acid.
§ Tartaric Acid.

COMPOSITION OF PRESERVES AND JAMS*

Fruit	Total Solids	Water Insoluble Solids	Ash	P_2O_5 in Ash	K_2O in Ash	Alk.† No. of Ash	Acid as Malic	Total Invert Sugar
	%	%	%	%	%	%	%	%
Apricot	70.15	1.48	.36	10	33	14	.82	64.96
Blackberry	72.83	3.42	.23	12	42	10	.71‡	65.89
(Seedless)	70.95	.15	.16	9	28	10	.53‡	67.72
Cherry	76.22	.91	.20	11	40	14	.73	71.20
Grape	72.56	.42	.17	10	28	10	.42§	67.00
Grape	71.60	1.20	.25	9	38	7	.59§	65.60
Grape	70.40	.50	.23	8	33	6	.53§	67.70
Loganberry	73.83	2.58	.23	13	42	13	.85‡	67.36
	72.26	2.12	.17	8	33	8	.97‡	65.64
Peach	70.72	.85	.23	8	38	8	.52	67.70
Pineapple	73.92	.86	.22	12	33	10	.58‡	67.45
Plum (Damson)	67.06	.82	.29	9	28	14	.85	62.40
	73.29	.61	.20	10	38	10	.74	68.56
	63.80	.59	.18	10	40	12	.48	59.20
Raspberry	69.15	2.74	.24	14	35	15	.93‡	64.15
	73.20	2.18	.19	12	38	12	.72‡	68.10
	71.60	2.44	.26	10	33	14	1.00‡	65.56
	70.59	3.58	.17	10	44	10	1.04‡	62.20
Strawberry	73.90	.65	.21	15	43	16	.89‡	67.00
	68.05	1.10	.18	13	38	12	.76‡	64.48
	70.32	1.72	.23	12	52	14	.75‡	64.88
Marmalade (70% Orange) (30% Lemon)	66.40	2.40	.25	18	40	16	.65‡	56.80

* Examined in author's laboratories, Shirley Laboratories, New York City, N. Y.
† C. C. Normal Acid required to neutralize the alkalinity in 1 gram of ash.
‡ As Citric Acid.
§ Tartaric Acid.

BRINING OF CHERRIES, CITRON, WATERMELON, LEMON, ORANGE, AND GRAPEFRUIT PEEL

By brining is meant placing the raw product in a solution of salt. Certain chemical changes take place, which preserve the fruits so that they can be used months or even years later. It also makes it possible to permit the shipping of raw materials from the source of supply to any destination or food factory. In some instances sulphurous salts are also used with the salt.

CHERRIES

Cherries that have been bleached to a yellowish-white shade in a sulphurous acid (sulphur dioxide) solution are known as "cherries in brine." The word brine means water impregnated with salt, or a combination of salt with other chemical ingredients. Brining methods are used to preserve foodstuffs, which themselves may be a complete food, like fish products, or foods to be processed into a finished product.

Brined cherries are prepared in the States of California, Washington, Oregon, Utah, Michigan, and New York, and also in Italy and France. The brine used for cherries consists of water impregnated with sulphurous acid, known as the preserving solution. The fresh cherries are filled into barrels and then covered with a 0.60% solution of sulphur dioxide.

PREPARATION OF SULPHUR DIOXIDE SOLUTION

The sulphur dioxide solution is prepared as follows:

Place the cylinder on a scale and weigh it. Then subtract from the gross weight 20 pounds. This 20 pounds of gas should be allowed to run into a barrel filled with 45 gallons of water. When the entire amount is in, the scale will be in true balance. The cylinder of gas is to be connected properly with rubber tubing conducting the gas into glass tubing, which goes through a hole on top of the barrel, and reaches down to the bottom. The time required for the gas to be dissolved in the water is about 10 hours. The strength of the solution in the barrel will now average between 4–5% of sulphur dioxide. Mark this solution "stock solution." By diluting with water, any desired strength may be attained.

BLEACHING CHERRIES

For bleaching or brining cherries, 5–8 gallons of stock solution of sulphur dioxide are diluted with 50 gallons of water. The barrels of cherries are then covered with this solution. Several weeks later the cherries will be bleached. The sulphur dioxide in the fruit is now around

0.25% or 2,500 parts per million. Before the bleaching is started, the sulphur dioxide is about .60% or 6,000 parts per million. During periods of long storing the brine or sulphur dioxide solution in the barrels must not drop below .22%. If it does, it should be reinforced to about .25%.

Another method of bleaching cherries is to add a solution of 2 pounds of sodium metabisulphite to each barrel holding about 250 pounds of fruit. Roll the barrel at least twice a day for several days. The time required for bleaching is generally from 10 days to 2 weeks.

CITRON

The citron may be brined with sea water, as it is done in foreign countries. The addition of the salt water at first sets up a fermentation in the citron. This has its advantages, for it removes bitterness through the opening of the pores and also develops flavor. After several weeks of equalization between the citron and liquid, the salt content will be about 8%. This concentration of salt is sufficient to preserve the citron for months and sometimes years, until made into the candied product. Instead of sea salt, ordinary salt can also be used for brining. Add the salt at the rate of 1% a day, thereby giving the citron a chance to undergo a slight fermentation. When the brine as well as the citron shows about 8% salt, the process is complete.

CITRON MELON

Citron melon is also brined. While it is called a substitute for citron, it is really not so. Citron melon develops molds quickly in a weak salt solution. Before adding salt, add about 3 pints of 4–5% stock solution of sulphur dioxide to each 100 pounds of citron melon. The salt is added in the same way as suggested for regular citron.

WATERMELON

The skin is removed from the rind, and then cured in a salt brine. To each 100 pounds of rind add about 14 pounds of salt and 2 pints of sulphur dioxide solution. The addition of sulphur dioxide prevents softening of the rind and also the growth of molds. The brine in which the rind is finally stored should contain at least 8% salt. The rind is used for candying purposes.

LEMON AND ORANGE PEEL

Lemon and orange peel are preserved in a salt brine. To each 100 pounds of lemon or orange peel add about 15 pounds of salt. Dissolve the salt in enough water to cover 100 pounds of peel. If the barrel is closed, it should be rolled several times in order to mix the salt solution. A very

small amount of sulphur dioxide stock solution may be added. This addition will soften up the white or rag on the peel, which is an advantage later on in candying the peel. For long storing the peel should contain at least 8% of salt by weight.

GRAPEFRUIT PEEL

After the juice and pulp is removed from the fruit, the peel is collected by companies who are in the brining business.

The white or rag of the grapefruit peel is heavier, thicker, and tougher than either the lemon or orange peel. The peel is ripened in a salt brine solution by slow additions of salt. During the first few days, it is advantageous for a slight fermentation to set in.

This will tend to soften the tough, white rag on the peel. The final salt concentration in the peel should test about 8%. A quart of sulphur dioxide stock solution is added to each 100 pounds of peel to prevent softening action of wild bacteria, and also growth of molds.

Other fruits packed in a weak solution of salt and varying percentages of sulphur dioxide are sliced pineapples, pears, figs, kumquats, apricots, peaches, and plums.

MARASCHINO CHERRIES IN SYRUP AND ALCOHOLIC BEVERAGES

The name Maraschino cherries is applied to all red cherries flavored with wild cherry or maraschino cherry flavor. In a United States decision No. 141 the term "Maraschino cherries" is defined as cherries preserved in true Maraschino cordial, prepared by fermentation and distillation from Marasca cherries. Cherries preserved in syrup and cherry flavor must therefore be labeled Maraschino Style cherries.

MARASCHINO STYLE CHERRIES

Maraschino cherries are used in cherry-flavored fountain syrups, ice-cream, garnishing for fruit cups, cocktails, bakery products, canned fruit salads, and confectionery.

VARIETIES OF CHERRIES

The cherry most commonly used is the sweet cherry such as the light-colored Royal Anne, or Waterhouse, and also the black cherries, such as the Bing, Lambert, Black Republican, Tartarian, Chapman, and others. The best cherries for making a high quality Maraschino style cherry are

the Royal Anne, Bing, and Lambert. Small to medium-sized cherries are usually preferred, while cherries with stems attached, used for cocktails, are generally made from larger cherries.

Other cherries which are sulphured or bleached for brining purposes are the sweet Napoleon, Windsor, and Smith varieties. These cherries grow mainly in the States of Michigan, New York, and Ohio.

Sour cherries are now also sulphured in large quantities for making into a Maraschino style cherry. These cherries grow abundantly in the States of Michigan, New York, California, Oregon, and a few others. As a rule, cherries which are to be bleached are picked just before they become fully ripe. If picked when too mature the pits will stick to the fruit and make difficult pitting. Also, if pickled when overripe, the flesh is tender and will not absorb the color properly. When the cherries have remained in the sulphur solution for several weeks, they are then sorted or graded according to quality and size.

Cherries are bought either by size or count. The size specifications are designated by millimeter measurements. There are at present four standard sizes:

1. Dipping cherries	10–14 mm.
2. Small cherries	14–18 mm.
3. Medium cherries	18–22 mm.
4. Large cherries	22–26 mm.

By count is meant the number of cherries required to fill a 1-gallon container. The cherries are graded in a motor-driven, perforated, rotary cylinder screen, and the various sizes are caught in barrels under the machine.

BLEACHING CHERRIES

The object in sulphuring the cherries is to arrest decay of the cherries temporarily, to bleach them to a uniform pale amber color, and also to give the fruit firmness. The bleaching chemical is sulphurous acid (sulphur dioxide) or sulphite salts.

Calcium Carbonate or calcium oxide, which has the tendency to harden the tissue of the fruit, may also be added.

PREPARATION OF SULPHUROUS ACID

The sulphurous acid is prepared by conducting sulphur dioxide gas from the cylinder into a barrel filled with water. About 20 pounds of the gas, slowly dissolving in 45 gallons of water, will give a solution testing about a 4 to 5% solution of sulphurous acid. This solution is the starting point for making sulphur solutions. By adding 5 gallons of the above

4–5% solution to 45 gallons of water, and then adding to this 1½–2 pounds of calcium carbonate or calcium oxide, there is obtained a solution to be used for bleaching the cherries. Usually 220–250 pounds of cherries are placed in the barrel and covered with this diluted sulphur water solution. Another method of bleaching cherries is to add to each barrel about 2 pounds of sodium metabisulphite, first dissolved in water. Also add to each barrel 6 ounces of milk of calcium carbonate or calcium oxide. Barrels best suited for brining are paraffin-lined, made of the best quality spruce or oak. The cherries should be stored in a cool warehouse for at least 60 days before use. For the first few days it is advisable to roll the barrels around three times a day, especially if unslaked lime is used. The brine should also be examined for its sulphur dioxide content. At no time should it be allowed to run under 2,500 parts per million or 0.25%. The barrel should always be full of brine, and leaky barrels should be coopered immediately. The cherries are considered bleached when they have attained a slight yellowish tint, and the fruit becomes toughened. Normally this takes 4 to 6 weeks. After this process the cherries are stemmed and graded into sizes in a mechanical grader built of stainless steel or Monel metal.

PITTING THE CHERRIES

The next operation is the removal of the cherry pits. Practically all cherries are pitted by hand, with a small pitting spoon similar in design to the well-known peach-pitting spoon. Pitting by machine is also practiced, but it is necessary for the cherries to be of uniform size. These cherries are called "special machine-pitted cherries."

Cherries pitted by one machine regardless of size are called common machine-pitted cherries. In this type of machine, many cherries are crushed, resulting in an inferior product.

LOSS FROM PITTING

There can be no definite statement as to what the pitting loss may be. It depends upon many factors:

1. Whether the cherries are of the free-stone or cling-stone type.
2. Whether the cherries are firm or soft.
3. Whether the pits are large or small.

With high-quality fruit, the average pit and stem loss should range about as follows:

1. Large fruit	15%	3. Small fruit	20%
2. Medium fruit	18%	4. Dipping fruit	24%

Shrinkage of original fruit, after brining, is about 10%.

METHOD OF MAKING MARASCHINO STYLE CHERRIES

For Maraschino cherries to be used in canned fruit, all of the sulphur dioxide must be removed. Any percentage left in the fruit may attack the tin lining of the can. In removing sulphur dioxide from the cherries it is customary to place the pitted cherries in large wooden troughs. The sulphur dioxide is leached out by a stream of cold, running water. The Food and Drug Administration allows 350 parts per million of sulphur dioxide in the finished Maraschino cherry. The State of Pennsylvania does not allow any at all. After the sulphur dioxide has been leached out the cherries are then transferred to steam-jacketed kettles and cooked in several changes of water until tender.

COLORING THE CHERRIES

The cherries are then dyed with pure food certified colors. Cherries to be used in canned fruit salads are dyed with an acid fast dye that will not bleed and discolor the other fruit. Erythrosine is used for the purpose. The dye can be used in a water solution and then heated with the cherries. A .025% solution of erythrosine in water is used or the cherries can be dyed in a weak solution of sodium bicarbonate and then the color is set fast with a citric acid solution. In this method, therefore, a .025% solution of erythrosine is prepared and made alkaline with .05% of sodium bicarbonate. The fruit and dye are set aside for several days. The dyeing can be hastened if fruit and dye solution are kept about 140° F. When the dye has penetrated through the cherries pour off the dye solution and then cover the cherries with a half of 1% citric acid solution. After several days the dye is set. The acid solution is then drained off, and the cherries are now sweetened with a 20° Baumé sugar syrup.

The other three permissible food colors used for dyeing cherries for cocktails, Maraschino type cherries, or garnishing purposes, are Poncean 3R, Poncean SX, and Amaranth. Poncean 3R, however, is the preferred color.

Cherries sold in glass bottles may contain the usually tolerated amount of sulphur dioxide, which is 350 parts per million, or one-tenth of 1% sodium benzoate, artificial color, acid, and bitter almond flavor. The usual final syrup in the bottles may be about 12 to 20° Baumé. Good results are obtained by making Maraschino cherries for bottles as follows: The cherries are leached with cold water, and for 200 pounds of fruit use about 1½–2 ounces of Poncean 3R certified food color. After the cherries have been dyed, the same 200 pounds of cherries are covered with a 22° Baumé sugar syrup. Also add separately, first, 7 ounces of sodium ben-

zoate, and then 4 ounces of citric acid. At the end of 10 days add another 50–60 pounds of cane sugar and allow to soak in the fruit.

The cherries are then flavored with 3 ounces of bitter almonds, dissolved in 3 ounces of alcohol.

Bulk cherries are sold in different sizes:

600 count 700 count 800 count 900 count 1000 count	Meaning number of cherries in 1 gallon.
1200 count 1300 count 1400 count	Dipping cherries used primarily for cordial chocolate-colored cherries.

A 50-gallon barrel of cherries contains 300 pounds of cherries and approximately 20 gallons of syrup.

Cherries are packed in 3-, 5-, 8-, 16-, 28-ounce glass jars, and also in ½- and 1-gallon jars. The 3-, 5-, 8-, 16-, and 28-ounce jars are pasteurized at 170° F. for 40 minutes. The ½- and 1-gallon jars are pasteurized at 180° F. for 1 hour.

With some exceptions the State laws governing the sale of Maraschino style cherries conform with the Pure Food and Drug Act of 1906. The exceptions are:

Pennsylvania	Allows no sulphur dioxide.
Wisconsin	Allows no sodium benzoate.
New York	Requires statement of amount of sulphur dioxide to be placed on label, 8-pt. brevier type.

TYPES OF CHERRIES (STANDARD TRADE TERMS)

Whole cherries	Cocktail cherries
Whole and broken cherries	Orange flavored cherries
Orchard run cherries	Lemon flavored cherries
Minced cherries	Peppermint flavored cherries
Crushed cherries	Spiced flavored cherries
Sliced cherries	Rum flavored cherries

MARASCHINO CHERRIES IN BRANDIES AND WINE SYRUPS

Fruits preserved in alcoholic beverages are very popular. The methods of packing cherries described in this chapter may also be used for other fruits, such as apricots, peaches, damson plums, and pears. The per-

centage of sugar present in the finished product may vary. The amount of spirituous ingredients be it brandy, wine, or rum, depends wholly on what the consumer likes. The use of alcohol alone, artificially flavored, is a poor substitute for brandies or wine, since straight alcohol has the tendency to toughen the fruit and impart a harsh, disagreeable taste. For processing Maraschino style cherries in wine, fortified wines like sherry or angelica are recommended. The wine should be aged for at least several years.

The Maraschino cherries used in spirituous liquors should average about 18–20 millimeters in size. They should not contain any sulphur dioxide, since the taste is objectionable. The cherries are packed in pint bottles, and 3 to 5 ounces of brandy or rum are added. The balance of the bottle is then filled with a 30° Bé. cane sugar syrup. It is advisable to pasteurize the product for 45 minutes at 175° F. Cherries packed in wines are prepared by adding 4 or 5 ounces of sherry or angelica to a pint of fruit, and to the balance of the bottle add a 30° Bé. cane sugar syrup. These bottles should also be pasteurized. There is no loss of alcohol content during the pasteurization period. Sufficient head space should be allowed in the bottles for expansion during pasteurization.

CANDIED AND GLACED FRUITS

Candied fruits are prepared by replacing the water in the fruit with sugar until impregnated with a high sugar content. In manufacturing this class of merchandise, the fruit must be handled very carefully and large amounts must not be cooked at one time. The use of certified food colors is permitted, if declared on the label. It is very seldom that a preservative is used, unless the manufactured product is purposely treated with less sugar.

Candied fruits are used extensively in the confectionery and baking industries. In fruit cakes they add flavor as well as eye appeal. In the candy industry they are coated with chocolate and make desirable confections.

CHERRIES

Glace or candied cherries are manufactured from the same raw material that is used for making the Maraschino style cherries. The fruit when picked should be hard ripe and of uniform color. The cherries should be washed and the blemished ones removed. The cherries are then put in barrels and bleached with sulphurous acid solution or chemical salts, as described in the chapter under Maraschino style cherries.

LEACHING OUT THE SULPLUR DIOXIDE

Bleaching of the fruit to a light yellowish tint makes a good base for the red color, which is used later on in the process. After the cherries have been bleached the sulphur dioxide content may run as high as .40%. The sulphur dioxide is removed by washing the cherries with cold water, in the original barrel, or by transferring several barrels of cherries to a large wooden trough, and allowing a continuous slow stream of water to come in from the bottom of the trough and to run out over the top. When the sulphur dioxide has been washed out so that only about .05% remains in the fruit, then the fruit is ready for the cooking process. The cherries are transferred to steam-jacketed kettles, covered with water, and cooked for about 20 minutes until they become tender. They are then cooled rapidly with cold running water. The fruit is then transferred to 3- and 5-gallon crocks or enamel pails, or to 20-gallon wooden tubs, and is ready to receive the sugar syrup and color.

HEATING FRUIT WITH SYRUP

The sugar syrup is prepared as follows:

Granulated Cane Sugar	100 lb.
Water	18 gal.
Citric Acid	2 oz.
Certified Red Color	½–¾ oz.

The sugar, water, acid and color are brought to a boil. Cover the cherries with this hot syrup. The syrup should read around 20° Bé. The red color may be Poncean 3R, Poncean SX, or a combination of both. Use ½–¾ ounce of color to every 200 pounds of fruit. The next day transfer fruit and syrup to the steam-jacketed kettle, and add enough sugar syrup to bring the Bé. up to 22°. Boil fruit and syrup for 1 minute and replace in containers. The following day pour fruit and syrup into the kettle, add sufficient sugar syrup to bring Bé. up to 24°. Again boil fruit and syrup for 1 minute and transfer hot fruit and syrup back into the containers. The next day transfer fruit and syrup back into the kettle, add enough sugar syrup to raise the Bé. up to 30°. Boil contents of kettle for 2 minutes. Now return the cherries and syrup to their containers and let stand for 48 hours. The cherries and syrup are now returned again to the kettle, sugar syrup is added to raise the Bé. to 33°. Bring the contents to a boil, and continue for 2 minutes, then return to their containers. Allow fruit and syrup to stand for 48 hours. Then transfer fruit and syrup to kettle and reinforce the sugar syrup to 36° Bé. with corn syrup. Bring contents to a boil and continue for 2 minutes. Replace contents of kettle into their containers, and let stand for 48

hours. Now pour fruit and syrup once more into kettle and reinforce the sugar syrup to 39° Bé. with corn syrup. Bring contents to a boil and continue for 2 minutes. Transfer the contents into their containers and let the candied cherries remain for at least 4 days, or even longer, in the containers before they are used. When the cherries are to be shipped, transfer fruit and syrup into the kettle and bring contents to a rapid boil. Then immediately scoop up the cherries on a perforated ladle and let excess syrup fall back into the kettle. Now place the cherries on draining screens and allow to remain overnight, during which time the excess syrup will drain off. The fruit will then be dry and ready for packing into containers.

PINEAPPLE

Glace pineapple slices or fingers are made from fresh pineapples or from fruit packed in a weak solution of sulphur dioxide and salt. Fresh pineapples arrive in May, June, and July, while pineapples in brine are available the year round. Fruit in brine is packed in Singapore and Cuba.

The fresh pines are difficult to handle. They are peeled, sliced, and then stamped out into proper sizes. The fruit is high in acid, is tough and fibrous, and should be processed quickly, since fermentation sets in very rapidly.

The sliced pineapple fingers, both fresh and canned, are transferred into barrels. Cover the fruit with cold water and add ½ pint of sulphurous acid stock solution. Let the whole stand for 24 or 48 hours. A very slight fermentation may set in. This is beneficial, since it softens the tough fibers of the fruit and will absorb the sugar uniformly later on in the process. The fruit is then transferred to the steam-jacketed kettle, covered with cold water, parboiled until tender, cooking about 20 minutes. The hot water is then allowed to run off, and then the fruit is covered with cold water until chilled. This restores a certain amount of crispness to the fruit.

HEATING FRUIT WITH SYRUP

Transfer the pineapple slices or fingers to shallow 3- or 5-gallon crocks, and cover with a hot 20° Bé. cane sugar syrup, acidulated with $\frac{1}{10}$ of 1% of citric acid. The next morning transfer the fruit and syrup to a 10-gallon tilting kettle, then add enough cane sugar, and boil the batch, until the syrup registers 20° Bé. hot. Return fruit and syrup to crocks. The following day repeat the procedure, boil until the syrup registers 22° Bé. hot. The next day repeat same procedure, boil until the syrup registers 25° Bé. hot. Repeat same procedure on the follow-

ing day, this time boiling until the syrup registers 28° Bé. hot. Allow the fruit to remain at rest for 48 hours. It is again transferred to the tilting kettle and for every 15 pounds of fruit add 4 pounds of corn syrup, 42° Bé. Boil for about 1 to 1½ minutes. The fruit is returned to the crock and allowed to stand for 48 hours. Now transfer to the kettle, add another 4 pounds of corn syrup, as above, and boil as outlined above. The fruit is again returned to the crock. At this point the syrup should register around 41° Bé. hot. If it does not, then continue the process of concentrating the syrup, after 48-hour rest periods, as suggested above. The pineapple should remain in the final syrup at least 4 days, before draining it for packing. The longer the fruit remains in the final syrup the plumper it becomes and the more additional weight it takes on. The ratio of cane sugar to corn syrup used above is 3 to 1. The minimum amount of total sugar solids necessary to prevent spoilage or fermentation of candied pineapples is 75%. A thoroughly cured product will contain as high as 85% total solids. Pineapples should always be thoroughly cured. If they are not, they may sweat, become tacky, shrink, and also lose their glace coating. If sugar crystals form on top of the crocks, after complete processing of the pineapples, this is an indication that too much cane sugar has been used. If this occurs, heat the contents of the crock and add a small amount of corn syrup, or acidulate with $\frac{1}{10}$ of 1 % of citric acid while cooking in the kettle.

DRAINING FRUIT FROM EXCESS SYRUP

The pineapple slices or fingers are drained from their final heavy syrup by transferring the contents of the crocks into the steam-jacketed kettles. The steam is turned on, and contents are brought to a quick boil. As soon as the fruit is rendered loose from the syrup, remove the fruit with perforated ladles and spread over draining screens. Allow to drain and dry overnight in this manner.

GLACEING PINEAPPLES

To glace pineapple slices or fingers the following procedure should be followed: place cane sugar and water in the ratio of 2 to 1 into the kettle, cook the mixture up to 235° F. Now shut off the steam. Add small amounts of the drained pineapple into the kettle. Rub the syrup up and down on one side of the kettle, and when the syrup starts to crystallize, bring the fruit under this area, and then, with a perforated ladle, transfer to draining screens. The fruit is straightened out by working quickly with forks. The glaceing should take place in a cool room, free from steam vapors. Allow to dry out on the screens for at least 24 hours before packing.

CITRON HALVES—LONG PROCESS

Citron halves come packed in a brine solution, containing about 8% of salt. The salt is used to preserve the rind for a long period until the manufacturer makes it into a candied product. The salt must be washed out completely. Transfer the fruit to large open wooden troughs or barrels and allow a steady stream of cold water to just run over the sides of the receptacles. Continue this operation until practically all of the salt is removed. The fruit is then cooked in the kettle, using several changes of water, for the purpose of removing bitterness, and making it tender. The practical test for tenderness is to take a piece of stiff copper wire and press it into the fruit. If it penetrates with very little resistance then the fruit is sufficiently tender.

After the fruit has been cooked with hot water, chill it thoroughly with cold water to restore crispness.

HEATING FRUIT WITH SYRUP

Now prepare a 22° Bé. hot cane sugar syrup, and add the citron to it. Boil the contents for 1½ minutes, and then transfer the citron to trough or to 25-gallon wooden tubs. The citron should be just covered with the hot syrup and pressed down. Remove the excess syrup, if any. The next day transfer citron and syrup to the kettle, and for every 100 pounds of citron add 20 pounds of cane sugar. Bring to a boil and continue boiling for 1½ minutes. Replace in receptacle again. For the next two days repeat the same operations. Now allow the citron and syrup to rest for 48 hours. Then transfer the batch to the kettle and for each 100 pounds of citron add 15 pounds of corn syrup 42° Bé. Bring to a boil and continue for 2 minutes. Replace in the receptacles. At the end of 48 hours transfer citron and syrup to the kettle, add another 15 pounds of corn syrup, bring to a boil, and continue doing so for 2 minutes. Replace in receptacles. Allow to rest for 48 hours. Now transfer again to the kettle, and for each 100 pounds of citron add another 10 pounds of corn syrup. Bring the contents to a boil and continue for 2 minutes. Replace in the receptacles and let rest for at least 6 days before draining. The final syrup should register around 41° Bé. hot. If it does not, then at the end of 48 hours, transfer syrup to the kettle and boil until it registers that Baumé. Cover the citron with this hot syrup. The longer the citron remains in the last syrup the better the product. It becomes more translucent, and takes on additional weight. When the rind is ready to be drained, transfer the syrup to the kettle. When brought to a boil, add small amounts of the citron, stirring around the hot syrup, and then placing them on the draining screens. If the citron

is to be glaced, cook up cane sugar and water to around 240° F. Shut off steam and place the citron halves in this concentrated syrup. Leave in for about 30 seconds and then carefully transfer to draining screens.

CITRON CUBES ¼″—SHORT PROCESS

The citron used in this process may be either the Italian or Puerto Rican citron. The Italian citron has a superior flavor. Without preliminary washing of the citron with cold water, the rind is put right through the dicing machine. In this process the dicing machine slices and cubes the peel in one operation. If the diced peel is ¼-inch size, it can be very satisfactorily processed in the quick way. If the cubes are larger, the longer process is recommended.

When dicing citron, be sure to remove stems, stones, pieces of wood, etc., as these impurities will break the knives of the machine. The diced citron should now be washed with cold running water. Remove practically all of the salt in this fashion, and be guided by the tasting of the cubes. Then transfer into the kettle, cover with cold water, bring to a boil, and continue doing so for about 2 minutes. Let this hot water drain off, and repeat the operations of cooking the rind until tender and neutral-tasting. From one to three hot washes are usually necessary, draining the wash water each time. When the citron is ready, cover with a 32° Bé. syrup. The contents of the kettle are now brought to a boil. Continue cooking, but not too vigorously, from 1¼–1½ hours, to finish the batch, from the time of adding the cold syrup to its completion. The rind is taken out of the kettle and spread thinly over draining screens. If a dry product is desired, place the screens in the drying room, about 120° F., for about 2 hours, otherwise overnight draining is sufficient. The syrup used in this process is made with 70 parts of cane sugar and 30 parts of corn syrup dissolved in the correct amount of water, until it shows 32° Bé.

ORANGE, LEMON, AND GRAPEFRUIT PEEL, HALVES—LONG PROCESS

These citrus peels come packed in a salt brine. The salt must be washed out with cold running water. The method to be used here can be the same as recommended for citron halves. The peel is then cooked in the kettle, using several changes of water. During these operations, the salt is further reduced, the bitterness is removed, and the peel is made tender enough to be processed successfully with sugar syrups. Two methods are suggested for syruping or sugar-curing the peels. One is to add increasing percentages of hot syrup over the peel, and the other is

to cook peel and syrup together in the kettle. The first method takes longer, but the product looks better.

METHOD NO. 1

The following procedure may be used with the orange, lemon, or grapefruit halves. Boil the peel with a 20° Bé. cane sugar syrup for 1 minute, then transfer to crocks or wooden half tubs. The next day place syrup in the kettle and for every 15 pounds of peel that the syrup covers add 3 pounds of cane sugar. Then bring this syrup to boiling and continue for ½ minute. Cover the peel again with this concentrated syrup. Repeat this operation twice, 24 hours apart. Again transfer syrup to the kettle, and for each 15 pounds of peel that the syrup covers add 4 pounds of corn syrup, 42° Bé. Bring to the boiling point and continue doing so for 1 minute. Then cover the peel with this syrup. Allow a 48-hour rest period, then again reinforce the syrup with another 4 pounds of corn syrup and proceed as above. The peel should be allowed to rest for at least 4 days before packing, and the syrup should register not less than 40° Bé. cold. If it does not, then boil up the syrup every 48 hours for 1½ minutes, cover the peel again, etc. The longer the peel remains submerged in the syrup the better and plumper the product will be. When the time comes for packing, the peel is drained from the syrup by cooking both peel and syrup in the kettle, and then spreading them out on draining screens. If a glace peel is desired, it must be submerged in a special sugar syrup, prepared as follows: Take 2 parts of cane sugar and 1 part of water, and boil to 238° F. Now close the steam valve. Add the peel to be glaced to the kettle, paddle them around for about ½ minute, and then place carefully on draining screens for drying.

The second method recommended for these peels is practically the same as for the citron. Follow these instructions, the only difference being that the final syrup in the citrus peels should be 40° Bé. cold.

ORANGE, LEMON, AND GRAPEFRUIT PEEL—SHORT PROCESS

In the following method, the peel is first put through the dicing machine, then transferred to the kettle in which the excess salt and bitterness are washed out with hot water. The cubes can be ¼, ⅜, or ½ inch in diameter. These methods can also be used for sliced orange, lemon, and grapefruit.

Pieces or halves of orange, lemon, or grapefruit peel can be used for dicing. No preliminary washing with cold water is necessary.

ORANGE AND LEMON PEEL

Take 200 pounds of the diced orange or lemon peel, transfer to a 75–80-gallon steam-jacketed kettle. Add enough cold water until peel swims around freely. Bring the contents of the kettle to a boil. Boil for about 5 minutes, and then let this hot water run off. Repeat this operation as many times as may be necessary to wash out the salt and bitterness. Usually three to five cooks are sufficient. The peel should also be tender. When the peel has been sufficiently washed, chill it with cold water to restore natural crispness. Now let this cold water run off, and fill the kettle with a 34° Bé. syrup, prepared by mixing 8 parts of 34° Bé. cane sugar syrup with 15 parts of 34° Bé. corn syrup. Also add to every 10 gallons of this syrup 1 ounce of dissolved citric acid. The contents of the kettle are now brought to a boil, and continued for about 10 minutes, paddling occasionally with a wooden oar. The hot syrup should now register between 20° and 22° Bé. hot. If it does not, then add water to bring it down or more syrup to bring it up to around 20°–22° Bé. With this adjustment made, continue boiling until the syrup registers 20° Bé. hot. The cooking should be so controlled that it will take about 35–45 minutes from start to finish. The peel is then transferred to draining screens and allowed to drain for at least 1 day. The peel can be dried if desired, in the drying room. To insure against fermentation and mold, the total solids in the product should not be less than 72%. Sodium benzoate may be added, the proportion being 1½ ounces to each 100 pounds of finished peel. Its presence must be declared on the label.

GRAPEFRUIT PEEL

Grapefruit peel can be had either in pieces, halves, strips, or even diced, and all come packed in a brine solution. Proper selection of peel is important, otherwise a mushy product will result. Without preliminary washing with cold water, the peel is put through the dicing machine. Transfer about 200 pounds to the kettle, and cover with cold water. Bring the contents of the kettle to a boil and continue for 45 minutes. Then let this water drain out. Repeat this operation several times, until the salt and bitterness are completely removed. This is accomplished after three to five washings. The peel should also be tender. If a colored (red or green) peel is desired, it can be colored in the last wash water. One ounce of red color (¾ part Poncean 3R and ¼ part Amaranth) is sufficient to color 200 pounds of peel and ¼ ounce of green color (¾ part Tartrazine and ¼ part Guinea Green B) is sufficient to color 200 pounds. The color can be dyed in by maintaining the contents of the last hot rinse

at a temperature around 180°–200° F. The color is usually taken up by the peel in about 30 minutes. The coloring operation is complete as soon as the white part of the peel has been penetrated. The peel can also be colored overnight in wooden tubs, if desired. The peel is now covered with a sugar syrup solution as outlined under orange. Add sufficient syrup so that the product swims about freely. Now bring the contents of the kettle to a boil and continue boiling for 10 minutes. The Baumé of the hot syrup should now read around 20°–22°. If not, make the adjustment as outlined under orange. Also, if more color is desired on the peel, this is the time to add it. The cooking is then continued until the syrup reads 28° Bé. hot. Try to regulate the cooking so that the syruping process is completed within 35–45 minutes. The peel is then drained while hot, on draining screens.

GRAPEFRUIT PEEL—SEMI-FINISHING PROCESS

It is possible to semi-process grapefruit peel at the source of origin. The best procedure is to select pieces of peel which are clear in color and without russet spots. The peel should be taken from the grapefruit in quarters. The next step is to place the peel in a large steam-jacketed kettle, cover with water, and bring to a slow boil, until the peel is suffiently tender so that it may be perforated with the finger-nail.

The peel is then taken out, cooled, and cut into the desired shapes. Cubing to the size of about ¼ inch makes a very attractive piece. After this has been done, the cubes should be placed in a clean barrel, with the head off. Barrel is then filled with water and left standing for about 3 hours.

By means of a hose or pipe, which reaches to the bottom of the barrel, the water is changed, and the barrel left standing again for 3 hours. This process is repeated until the extreme bitterness of the peel has been neutralized to a stage that only a slight part of the bitterness remains.

At this point, the cubes are removed from the barrel and the water is eliminated from them, either by a centrifugal or some other desirable means. After this has been accomplished, the cubes are subjected to a high-speed glace process and placed in barrels, covered with sufficient syrup, and shipped to destination, where the draining and finishing process can take place.

In this shape, the peel can be readily used for fruit mixes. As a matter of fact, if treated with a little oil of orange, it will almost taste better than the orange peel itself.

MELON RIND, 1/4″ DICED—SHORT PROCESS

The rind of the watermelon or citron melon is usually used. The rind is firm, tasteless, translucent, and can be dyed satisfactorily, especially red. While being processed with sugar syrup it becomes naturally green in color. Dice the rind without washing out the salt. Transfer 200 pounds to the kettle, cover with water, and bring to a boil. After boiling about 10 minutes, drain off the hot water. Repeat this operation several times until the rind is neutral-tasting. Chill the rind with cold water after the hot washes. Now cover the product with a 34° Bé. sugar syrup, made by mixing 50 parts of 34° Bé. cane sugar syrup with 50 parts of 34° Bé. corn syrup. Bring contents of the kettle to a boil, and continue doing so for 15 minutes. The syrup should now register about 22° Bé. hot. If it does not then adjust it accordingly. The cooking is continued, with occasional stirring, until the syrup registers 28° Bé. hot. Regulate the cooking so that it will take 35–45 minutes for complete syruping. The hot rind is now drained and dried in the drying room. The rind may also be colored red or green in the same way as outlined under grapefruit peel.

CHAPTER XIV

COMPOSITION AND CAKING OF FOODS, ACID AND ALKALI FORMING FOODS, HYDROGEN ION CONTROL, ANALYSIS AND TESTS

COMPOSITION OF COMMON VEGETABLES
(EDIBLE PORTION)

NAME	PERCENTAGE BY WEIGHT							MILLIGRAMS PER KILOGRAM [1]	
	Protein	Carbohydrate	Fat	Crude Fiber	Ash	Calcium	Phosphorus	Iron	Copper
Artichoke (globe)	2.9	11.9	0.4	3.2	1.1	.031	.087	20.0	3.1
Asparagus	1.8	3.3	0.2	0.8	0.7	.025	.039	10.0	1.4
Beans, dry	22.5	60.0	1.8	4.4	3.5	.160	.471	95.2	6.9
Beans, green	2.3	7.4	0.3	1.9	0.8	.046	.052	9.3	1.0
Beans, baked	6.9	19.6	2.5	1.4	2.1	.052	.155	32.0	2.3
Beets	1.6	9.7	0.1	0.9	1.1	.029	.039	23.6	1.9
Beet leaves	2.0	4.2	0.3	1.4	1.7	...	...	35.5	0.9
Cabbage	1.6	5.6	0.3	1.1	1.0	.045	.029	3.5	0.5
Cantaloupe	0.6	9.3	0.3	2.1	0.6	.017	.015	5.1	0.6
Carrots	1.1	9.3	0.4	1.1	1.0	.056	.046	6.4	0.8
Cauliflower	1.8	4.7	0.5	1.0	0.7	.123	.061	9.4	1.4
Celery	1.1	3.3	0.1	1.0	1.0	.078	.037	6.2	0.1
Chard	2.6	4.0	0.4	0.8	1.2	.150	.040	31.0	1.1
Corn, Canned	2.8	19.0	1.2	0.8	0.9	.006	.103	4.7	1.0
Cucumber	0.8	3.1	0.2	0.7	0.5	.016	.033	3.3	0.6
Eggplant	1.2	5.1	0.3	0.8	0.5	.011	.034	5.0	1.0
Kale	3.9	6.0	0.6	1.2	1.7				
Lettuce	1.2	2.9	0.3	0.7	0.9	.043	.042	7.0	0.4
Mushrooms	3.5	6.8	0.4	0.9	1.1	.017	.108	31.0	17.9
Onions	1.6	9.9	0.3	0.8	0.6	.034	.045	4.0	0.8
Parsnips	1.6	13.5	0.5	2.5	1.4	.059	.076	10.7	1.2
Peas, dry	24.6	62.0	1.0	4.5	2.9	.084	.400	57.0	14.0
Peas, green	7.0	16.9	0.5	1.7	1.0	.028	.127	21.0	2.4
Peppers, green	1.1	4.6	0.1	1.4	0.7	.006	.026	4.0	1.0
Potatoes (white)	2.2	18.4	0.1	0.4	1.0	.014	.058	9.1	1.7

[1] Parts per million.

COMPOSITION OF COMMON VEGETABLES—*Continued*
(EDIBLE PORTION)

Name	Percentage by Weight							Milligrams per Kilogram [1]	
	Protein	Carbohydrate	Fat	Crude Fiber	Ash	Calcium	Phosphorus	Iron	Copper
Potatoes (sweet)	1.8	27.4	0.7	1.3	1.1	.019	.045	9.0	1.5
Pumpkin	1.0	5.2	0.1	1.2	0.6	.023	.059	9.3	0.3
Radishes	1.3	5.8	0.1	0.7	1.0	.021	.029	8.3	1.6
Rhubarb	0.6	3.6	0.7	1.1	0.7	.044	.031	7.6	0.5
Rutabagas	1.3	8.5	0.2	1.2	1.1	.074	.056	6.6	1.5
Sauerkraut	1.7	3.8	0.5	1.0	5.2	.040	.025	4.0	0.4
Spinach	2.1	3.2	0.3	0.9	2.1	.067	.068	38.5	1.2
Squash (Hubbard)	1.4	9.0	0.5	0.8	0.8	.019	.015	5.0	0.4
Tomatoes	0.9	3.9	0.4	0.6	0.5	.011	.026	6.0	0.7
Turnips	1.3	8.1	0.2	1.3	0.8	.064	.046	6.2	0.9
Turnip Tops	2.9	4.2	0.4	1.2	1.8				
Watermelon	0.4	6.7	0.2	1.0	0.3	.011	.003	2.3	0.7

[1] Parts per million.

COMPOSITION OF NUTS
(EDIBLE PORTION)

Name	Percentage by Weight							Milligrams per Kilogram [1]	
	Protein	Carbohydrate	Fat	Crude Fiber	Ash	Calcium	Phosphorus	Iron	Copper
Almonds	21.0	17.3	54.9	2.0	2.0	.239	.465	40	12.1
Brazil Nuts	17.0	7.0	66.8	3.9	3.9	...	...	40	13.9
Butternuts	27.9	3.5	61.2	...	...	...	...	68	12.0
Chestnuts, fresh	6.2	42.1	5.4	1.8	1.3	.034	.093	41	6.0
Coconut, dry	6.3	31.5	57.4	3.4	1.3	.059	.155	20	6.9
Hazelnuts	...	...	...	3.0	2.1	.287	.354	41	
Peanuts	25.8	24.4	38.6	2.5	2.0	.071	.399	20	9.6
Pecans	11.0	13.3	71.2	2.2	1.5	.089	.335	26	13.6
Pistachios	22.3	16.3	54.0	...	3.2	...	...	79	12.0
Walnuts, English	18.4	13.0	64.4	1.4	1.7	.060	.360	21	10.0
Walnuts, black	27.6	11.7	56.3	1.7	1.9	...	...	60	

[1] Parts per million.

COMPOSITION OF COMMON FRUITS
(EDIBLE PORTION)

Name	Percentage by Weight							Milligrams per Kilogram [1]	
	Protein	Carbohydrate	Fat	Crude Fiber	Ash	Calcium	Phosphorus	Iron	Copper
Apples	0.4	14.2	0.5	1.2	0.3	.007	.012	5.0	1.0
Apricots	1.1	13.4	0.3	3.1	0.5	.014	.025	25.0	1.8
Avocados	2.1	7.4	20.1	......	0.9				
Bananas	1.3	22.0	1.3	1.0	0.8	.009	.031	17.6	2.1
Blackberries	1.3	10.9	1.0	2.5	0.5	.017	.034	10.0	1.6
Cherries	1.0	16.7	0.8	0.2	0.6	.019	.031	4.0	1.4
Cranberries	0.4	9.9	0.6	1.5	0.2	.017	.011	4.4	0.9
Dates (dried)	2.1	78.4	2.8	5.5	1.3	.065	.056	36.0	3.8
Figs (dried)	4.3	74.2	0.3	7.3	2.4	.162	.116	29.0	3.5
Grapefruit	0.6	12.2	0.1	......	......	.021	.020	2.7	0.3
Grapes	1.3	19.2	1.6	4.3	0.5	.019	.031	7.3	0.9
Lemons	1.0	8.5	0.7	1.1	0.5	.036	.022	6.0	0.4
Oranges	0.8	11.6	0.2	......	0.5	.045	.021	5.2	0.8
Peaches	0.7	9.4	0.1	3.6	0.4	.016	.024	3.5	0.9
Pears	0.6	14.1	0.5	2.7	0.4	.015	.026	3.5	1.0
Pineapple	0.4	9.7	0.3	0.4	0.3	.018	.028	3.7	0.7
Prunes (dried)	2.1	73.3	7.3	1.5	2.5	.054	.105	29.0	4.1
Raisins	2.6	76.1	3.3	1.7	3.4	.064	.132	29.0	2.0
Raspberries	1.7	12.6	1.0	2.9	0.6	.049	.052	8.8	1.4
Strawberries	1.0	7.4	0.6	1.4	0.6	.041	.028	6.8	0.2

[1] Parts per million.

COMPOSITION OF CEREALS
(EDIBLE PORTION)

NAME	PERCENTAGE BY WEIGHT							MILLIGRAMS PER KILOGRAM [1]	
	Protein	Carbohydrate	Fat	Crude Fiber	Ash	Calcium	Phosphorus	Iron	Copper
Barley, pearled...	8.5	77.8	1.1	0.3	1.1	.020	.181	20	4.0
Bread, white.....	9.2	53.1	1.3	0.5	1.2	.027	.093	9	3.4
Bread, whole wheat	9.7	49.7	0.9	1.2	1.3	.050	.185	30	5.0
Bread, rye........	9.0	53.2	0.6	0.5	1.5	.024	.148	16	
Corn meal........	9.2	75.4	1.9	1.0	1.0	.018	.190	9	2.0
Flour, white......	13.3	72.7	1.5	0.7	0.6	.020	.092	10	1.7
Flour, rye........	6.8	78.6	0.9	0.4	0.7	.018	.289	13	4.2
Flour, buckwheat.	6.4	77.9	1.2	.....	.....	.010	.176	12	
Hominy	8.3	79.0	0.6	0.9	0.3	.011	.144	9	1.9
Macaroni	13.4	74.1	0.9	0.4	1.0	.022	.144	12	
Oatmeal	16.1	67.5	7.2	0.9	1.9	.069	.392	38	5.0
Rice, white.......	8.0	79.0	0.3	0.2	0.4	.009	.096	9	1.9
Soy Bean, meal...	40.0	7.0	21.0						
Tapioca	0.4	88.0	0.1	0.1	0.1	.023	.090	16	
Wheat, whole.....	11.1	75.5	1.7	1.8	1.8	.045	.423	50	6.0
Wheat, bran......	14.6	46.5	3.8	11.3	5.0	.120	1.215	78	11.7

[1] Parts per million.

COMPOSITION OF MEATS AND POULTRY PRODUCTS
(Edible Portion)

Name	Percentage by Weight							Milligrams per Kilogram [1]	
	Protein	Carbohydrate	Fat	Crude Fiber	Ash	Calcium	Phosphorus	Iron	Copper
Bacon	10.5	...	64.8	...	4.4	.006	.108	24	5.0
Beef, Steak	18.9	...	18.5	...	1.0	.012	.216	30	1.0
Chicken	21.5	...	2.5	...	1.1	.012	.232	32	3.5
Duck	18.0	...	19.0	...	...	.010	.200	23	5.0
Eggs	13.4	...	10.5	...	1.0	.067	.180	30	2.3
Egg, White	12.3	...	0.2	...	0.6	.015	.014	1	
Egg, Yolk	15.7	...	33.3	...	1.1	.137	.524	86	1.2
Fish, Cod	11.1	...	0.2	...	1.2	.012	.120	6	5.5
Fish, Halibut	18.6	...	5.2	...	1.0	.020	.200	10	2.3
Fish, Salmon	22.0	...	12.8	...	1.4	.025	.250	12	2.0
Fish, Tuna	26.6	...	11.4	...	1.7	.030	.300	15	5.0
Gelatin	91.4	...	0.1	...	1.0				
Ham	19.8	...	20.8	...	0.8	.012	.215	30	
Liver, Beef	20.4	1.7	4.5	...	1.6	.017	.213	79	21.5
Lobster	16.4	0.4	1.8	...	...	.018	.188	9	7.0
Margarine	1.2	...	83.0	...	3.0				
Mince Meat	6.7	60.2	1.4	...	...	.085	.175	30	
Mutton, Leg	19.8	...	12.4	...	1.2	.010	.270	30	4.0
Oysters	6.2	3.7	1.2	...	1.5	.052	.155	45	30.8
Pork, Chops	16.6	...	30.1	...	0.7	.010	.180	25	3.1
Shrimp	25.4	0.2	1.0	...	...	.096	.292	27	
Turkey	21.1	...	22.9	...	1.0	.030	.420	45	1.8
Veal, Cutlet	20.3	...	7.7	...	1.1	.013	.228	30	2.5

[1] Parts per million.

COMPOSITION OF DAIRY PRODUCTS
(Edible Portion)

Name	Percentage by Weight							Milligrams per Kilogram [1]	
	Protein	Carbohydrate	Fat	Crude Fiber	Ash	Calcium	Phosphorus	Iron	Copper
Butter	1.0	...	85.0	...	3.0	.015	.017	2.0	
Buttermilk	3.0	4.8	0.5	...	0.7	.105	.097	2.5	
Cheese, American	29.0	0.3	36.0	...	3.4	.930	.683	13.8	1.8
Cheese, Cottage	20.9	4.3	1.0	...	4.2	.995	.374		
Cheese, Swiss	27.6	1.2	35.0	...	4.8	.999	.845	12.5	1.3
Cheese, Cheddar	27.7	4.1	36.8	...	4.0	.990	.682	12.5	
Cream	2.5	4.5	18.5	...	0.5	.090	.080	2.2	
Ice Cream	4.0	20.0	14.0	...	0.9	.150	.120		
Milk, Whole	3.3	5.0	4.0	...	0.7	.120	.093	2.4	0.2
Milk, Skim	3.4	5.1	0.3	...	0.8	.122	.096	2.5	0.2
Milk, Evaporated	8.7	10.2	8.2	...	1.5	.250	.200	5.3	1.2
Milk, Condensed	8.8	54.1	8.3	...	1.6	.300	.235	6.0	1.0
Milk, Dried	26.1	38.0	26.5	...	6.0	.920	.710	1.5	1.5

[1] Parts per million.

MISCELLANEOUS

PREVENTION OF CAKING OF POWDERED FOOD PRODUCTS

The ingredients most commonly used to retard caking are listed in the order of their effectiveness:

SUBSTANCES

Tri-calcium phosphate
Magnesium carbonate
Unslaked lime
Sodium bicarbonate
Di-calcium phosphate
Calcium sulphate, anhydrous
Corn starch, dry
Dextrose, anhydrous
Vegetable shortening (melting point, 92°–98° F.)

USE OF ALKALIES IN BOTTLE WASHING

The following alkalies are used in bottle washing:

1. Sodium hydroxide or caustic soda or lye.
2. Sodium carbonate (anhydrous), also called soda ash, is used with

STATE REQUIREMENTS GOVERNING TYPE AND STRENGTH OF SOLUTIONS FOR WASHING BOTTLES

State	Solution	Temperature	Soaking Time
Alabama	3% Alkali (comprising 60% caustic)	120° F.	5 min.
Arizona	No specific provision	......	....
Arkansas	Bottles must be sterilized	......	....
California	No specific provision	......	....
Colorado	No specific provision	......	....
Connecticut	3½% Alkali	120° F.	5 min.
Delaware	3½% Caustic	120° F.	3 min.
Dist. of Col.	Bottles must be thoroughly washed	......	....
Florida	No specific provision	......	....
Georgia	No specific provision	......	....
Idaho	No specific provision	......	....
Illinois	No specific provision	......	....
Indiana	3% Caustic, or caustic equivalent	120° F.	5 min.
Iowa	3% Caustic, or caustic equivalent	120° F.	5 min.
Kansas	3% Caustic, or caustic equivalent	125° F.	10 min.
Kentucky	3% Alkali (comprising 1.8% caustic)	120° F.	....
Louisiana	3% Caustic, or caustic equivalent	120° F.	....
Maine	Bottles must be sterilized	......	....
Maryland	2½% Caustic, or caustic equivalent	125° F.	....
Massachusetts	Bottles must be cleaned and sterilized	......	....
Michigan	3% Caustic, or caustic equivalent	120° F.	5 min.
Minnesota	4% Caustic, or caustic equivalent	110° F.	5 min.
Mississippi	5% Caustic (or equivalent disinfectant)	112° F.	10 min.
Missouri	3% Alkali	......	....
Montana	3% Caustic, or caustic equivalent	......	....
Nebraska	4% to 5% Caustic	140 to 160° F.	10 min.
Nevada	No specific provision	......	....
New Hampshire	3½% Caustic, or caustic equivalent	120° F.	5 min.
New Jersey	3% Alkali (renewed weekly)	125° F.	10 min.
New Mexico	5% Caustic	......	10 min.
New York	No specific provision	......	....
North Carolina	Bottles must be soaked in alkali or caustic	......	....
North Dakota	No specific provision	......	....
Ohio	3% Caustic, or caustic equivalent	120° F.	5 min.
Oklahoma	Bottles must be soaked in hot chemical solution	......	10–20 min.
Oregon	No specific provision	......	....
Pennsylvania	3% Caustic	110° F.	5 min.
Rhode Island	3% Caustic, or caustic equivalent	100° F.	5 min.
South Carolina	No specific provision	......	....
South Dakota	3% Caustic, or caustic equivalent	120° F.	5 min.
Tennessee	No specific provision	......	....
Texas	3% Caustic, or caustic equivalent	120° F.	....
Utah	No specific provision	......	....
Vermont	Sterilized with boiling water or steam	......	....
Virginia	Sterilized with boiling water or steam	......	....
Washington	No specific provision	......	....
West Virginia	No specific provision	......	....
Wisconsin	5% Alkali or 3% caustic	125° F.	10 min.
Wyoming	No specific provision	......	......

caustic soda as the base of most washing powders. It is a good detergent, and rinses off easily. When used with caustic soda it has greater germicidal power.

3. Trisodium phosphate. A very efficient detergent. It rinses off easily. It can be used in combination with caustic soda or soda ash or by itself.

4. Sodium metasilicate. A good detergent. It is used in combination with trisodium phosphate.

The sterilizing power of the washing solution depends upon the amount of alkali present. The solution should be prepared at least 10% stronger than called for in the state regulations. At no time should it be allowed to drop lower than that required by law.

Heat, as well as alkali, is necessary to insure sterile bottles. The standard temperature to use is around 130° F. for at least five minutes. The final rinsing of the bottles should be with water of the highest sanitary quality. After the bottle has been rinsed, it should be free from alkali. This can be found out by adding a few drops of a 1% alcoholic solution of phenolphthalein to the rinsed bottle. If no red color appears, there is no free alkali left in the bottle. No process of washing and filling would be complete without adequate inspection of the empty bottle and the finished product.

ACID-FORMING AND ALKALI-FORMING FOODS

A normal diet should contain sufficient alkaline ash foods to balance the acid ash foods. When the alkalinity of the body is decreased below normal, "acidosis" results. Most foods when oxidized or used up in the body produce a mineral salt which is either acid or alkaline in reaction, depending on what mineral constituents are present in the food. If this is soluble in the body fluids, it is largely excreted through the kidneys. When foods yielding an acid ash predominate in the diet, a condition of acidosis may result unless the resulting constituents are neutralized with alkaline ash foods.

ACID-FORMING FOODS, STARTING WITH THOSE FOODS HAVING THE LEAST AMOUNT OF ACID-FORMING ASH

1. Peanuts
2. Egg white
3. Corn, sweet dried
4. Crackers
5. Rice
6. Wheat, entire
7. Eel
8. Frog meat
9. Egg
10. Pike fish
11. Meat, pork, lean
12. Wheat flour

13. Oatmeal
14. Meat, veal
15. Meat, beef, lean
16. Meat, venison
17. Fish, haddock
18. Meat, chicken
19. Cheese
20. White bread

ALKALI-FORMING FOODS, STARTING WITH THOSE FOODS HAVING THE LEAST AMOUNT OF ALKALI-FORMING ASH

1. Asparagus
2. Onions
3. Pumpkins
4. Turnips
5. Watermelon
6. Apples
7. Figs
8. Lemon juice
9. Oranges
10. Orange juice
11. Lemons
12. Mushrooms
13. Peaches
14. Milk, cow
15. Peas, dried
16. Cherry juice
17. Pears
18. Currants, dried
19. Radishes
20. Raspberry juice
21. Tomato juice
22. Tomatoes
23. Strawberries
24. Bananas
25. Cauliflower
26. Celery
27. Apricots
28. Bam
29. Citron
30. Cabbage
31. Chestnuts
32. Cucumbers, fresh
33. Muskmelon
34. Grapes
35. Pineapples
36. Potatoes
37. Potatoes, sweet
38. Beets
39. Carrots
40. Dates
41. Parsnips
42. Chard
43. Cottonseed meal
44. Almonds
45. Beans, dried
46. Raisins
47. Spinach
48. Linseed oil meal
49. Beans, lima, dried
50. Olives
51. Soy bean

HYDROGEN ION CONTROL

Foods may be either acid or alkaline. This factor has a marked effect on the quality of the product and determines whether bacteria will grow or whether fermentation will ensue. The old methods of testing for acidity or alkalinity, be it by means of litmus paper indicators or by titration, often gave misleading results. These methods show how much acid

or alkali is present, and from these findings made it possible to classify them as very acid, very alkaline, moderately acid, etc.

Acidity and alkalinity of foodstuffs are now on a definite scientific basis, since the introduction of pH control. Acidity and alkalinity can now be expressed numerically and can now be duplicated by any worker anywhere.

The numbers from 0 to 14 are used to express pH values. The value pH 7.0 is the neutral point, that is, neither acid nor alkaline. The numbers below 7.0 denote acidity, the intensity of the acidity increasing as the numbers decrease. The numbers from 7 to 14 denote alkalinity, the alkalinity increasing as the numbers increase.

In making pH determination, indicators are used. An indicator is a chemical substance, that gives different shades of color for different pH values. Thus, phenol red changes from yellow at pH 6.8 to a deep red at pH 8.4; that is, if phenol red is added to a solution having a pH of 6.8 it will give this solution a yellow color. If added to another solution of pH 7.0 it will give a somewhat redder shade of yellow. If added to other solutions having pH values of 7.2, 7.4, 7.6, etc., the amount of red color imparted to the solution will increase progressively until at pH 8.4 the solution will have a deep red color. Therefore if phenol red is added to any solution having a pH value between 6.8 and 8.4, the pH of that solution is determined by observing the color obtained.

Phenol red covers only a limited part of the pH scale but other indicators are available for other parts. Thus bromcresol green covers the range pH 3.8–5.4 and its color change is from yellow at pH 3.8 to blue at pH 5.4. Thymol blue covers the range pH 8.0–9.6 and its color change is from yellow at pH 8.0 to blue at pH 9.6.

All indicators are made up in the form of solutions of definite strengths and these standardized solutions should be used in making all pH determinations.

In making a test on a material of unknown pH it is best to first make an approximate determination. To do this a few 5-cc. test tubes and 0.5-cc. pipettes and a supply of the various indicator solutions are required. Three tubes are filled to the mark (5 cc.) with the material to be tested. To the first is added 0.5 cc. of bromcresol green indicator solution (pH 3.8–5.4), to the second 0.5 cc. of bromthymol blue (pH 6.0–7.6), and to the third 0.5 cc. of phthalein red (pH 8.6–10.2).

When it is necessary to make a solution or a suspension of a product, in order to determine its pH value, the water used should of course be as nearly neutral as possible, as any acidity of the water will affect the pH of the dissolved material. Water having a pH value of 6.6 to 6.8 is satisfactory for this work. In making these solutions, the proportion of mate-

Name	pH Range	Color Change	Strength of Solution
Acid Cresol Red	0.2– 1.8	Red-Yellow	.02%
Acid Meta Cresol Purple	1.2– 2.8	Red-Yellow	.04%
Thymol Blue	1.2– 2.8	Red-Yellow	.04%
Benzo Yellow	2.4– 4.0	Red-Yellow	
Bromphenol Blue	3.0– 4.6	Yellow-Blue	.04%
Bromcresol Green	3.8– 5.4	Yellow-Blue	.04%
Methyl Red	4.4– 6.0	Red-Yellow	.02%
Chlorphenol Red	5.2– 6.8	Yellow-Red	.04%
Bromcresol Purple	5.2– 6.8	Yellow-Purple	.04%
Bromthymol Blue	6.0– 7.6	Yellow-Blue	.04%
Phenol Red	6.8– 8.4	Yellow-Red	.02%
Cresol Red	7.2– 8.8	Yellow-Red	.02%
Meta Cresol Purple	7.6– 9.2	Yellow-Purple	.04%
Thymol Blue	8.0– 9.6	Yellow-Blue	.04%
Phthalein Red	8.6–10.2	Yellow-Red	
Tolyl Red	10.0–11.6	Red-Yellow	
Parazo Orange	11.0–12.6	Yellow-Orange	
Acyl Blue	12.0–13.6	Red-Blue	

rial to water should always be kept the same, for example 10 g. of material to 50 cc. of water, so that different determinations will be comparable. It is of course equally true that the indicator solutions should have a neutral reaction, since any excess acid or alkali will likewise change the pH value of the material.

The approximate pH can usually be determined by observing the colors in these three tubes. Thus if the color of the first tube is between yellow and blue, that is, if it is greenish yellow, green or greenish blue, the pH of the material lies between pH 3.8 and 5.4. If the color of the second tube is between yellow and blue, the pH of the sample lies between pH 6.0 and 7.6. If the color of the third tube is between yellow and red the pH of the sample lies between 8.6 and 10.2.

These three indicators, pH 3.8–5.4, 6.0–7.6, and 8.6–10.2, do not completely cover the range pH 3.8–10.2. However, if the first tube gives a blue color and the second a yellow color, the pH of the material is between pH 5.4 and 6.0 or in the range of chlorphenol red (pH 5.2–6.8). Likewise if the second tube has a blue color and the third a yellow color the pH is between 7.6 and 8.6 or in the range of cresol red (pH 7.2–8.8).

Finally, if on adding bromcresol green to the first tube a yellow color is obtained, the pH of the material is probably below 3.8. In this case 0.5 cc. of acid meta cresol purple (pH 1.2–2.8) should be added to the second tube and the color observed. Similarly if on adding phthalein red to the

third tube a red color is obtained, another test should be made with parazo orange (pH 11.0–12.6).

Suppose that the approximate determination showed the pH of the material to be within the range of bromcresol green (pH 3.8 to pH 5.4). To determine the exact pH a set of bromcresol green color standards is required. These standards can be made by adding 0.5 cc. of bromcresol green to each of the nine tubes containing 5 cc. of solutions having the pH values 3.8, 4.0, 4.2, 4.4, 4.6, 4.8, 5.0, 5.2, 5.4, respectively. The pH values are placed directly above the standards. By matching the color of the sample against the bromcresol green standards its exact pH is determined. Thus, if it matches the standard 4.4, the pH of the sample is 4.4. If it lies between the colors of standards 4.4 and 4.6, the pH of the sample is 4.5. If the approximate determination showed that the pH of the sample is between 5.2 and 6.8 the accurate determination is made by comparing a test sample to which chlorphenol red has been added with chlorphenol red color standards.

If the materials being tested are absolutely clear and colorless accurate determinations can be made by comparing the color of the test sample with those of the color standards, as outlined above. Most solutions encountered in actual practice are, however, somewhat turbid or colored or both. Therefore when an indicator solution is added to such a material the resulting color will not match with the color standards which contain none of the color or turbidity of the sample. For this reason, the solution of the food should be filtered with a little carbon, until clear, and the proper indicator then added.

APPROXIMATE pH VALUES

The following tables give approximate pH values for a number of substances such as acids, foods, biological fluids, etc. All values are rounded off to the nearest tenth and are based on measurements made at 25° C.

pH VALUES OF ACIDS

Hydrochloric, N	0.1	Formic, 0.1N	2.3
Hydrochloric, 0.1N	1.1	Lactic, 0.1N	2.4
Hydrochloric, 0.01N	2.0	Acetic, N	2.4
Sulfuric, N	0.3	Acetic, 0.1N	2.9
Sulfuric, 0.1N	1.2	Acetic, 0.01N	3.4
Sulfuric, 0.01N	2.1	Benzoic, 0.1N	3.1
Orthophosphoric, 0.1N	1.5	Alum, 0.1N	3.2
Sulfurous, 0.1N	1.5	Carbonic (Saturated)	3.8
Oxalic, 0.1N	1.6	Hydrogen Sulfide, 0.1N	4.1

Tartaric, 0.1N	2.2	Arsenious (Saturated)	5.0
Malic, 0.1N	2.2	Hydrocyanic, 0.1N	5.1
Citric, 0.1N	2.2	Boric, 0.1N	5.2

pH VALUES OF BASES

Sodium Hydroxide, N	14.0	Ammonia, N	11.6
Sodium Hydroxide, 0.1N	13.0	Ammonia, 0.1N	11.1
Sodium Hydroxide, 0.01N	12.0	Ammonia, 0.01N	10.6
Potassium Hydroxide, N	14.0	Potassium Cyanide, 0.1N	11.0
Potassium Hydroxide, 0.1N	13.0	Magnesia (Saturated)	10.5
Potassium Hydroxide, 0.01N	12.0	Sodium Sesquicarbonate, 0.1M	10.1
Lime (Saturated)	12.4	Ferrous Hydroxide (Saturated)	9.5
Sodium Metasilicate, 0.1N	12.6	Calcium Carbonate (Saturated)	9.4
Trisodium Phosphate, 0.1N	12.0	Borax, 0.1N	9.2
Sodium Carbonate, 0.1N	11.6	Sodium Bicarbonate, 0.1N	8.4

pH VALUES OF FOODS

Apples	2.9–3.3	Milk, cows	6.3–6.6
Apricots	3.6–4.0	Olives	3.6–3.8
Asparagus	5.4–5.8	Oranges	3.0–4.0
Bananas	4.5–4.7	Oysters	6.1–6.6
Beans	5.0–6.0	Peaches	3.4–3.6
Beers	4.0–5.0	Pears	3.6–4.0
Beets	4.9–5.5	Peas	5.8–6.4
Blackberries	3.2–3.6	Pickles, dill	3.2–3.6
Bread, white	5.0–6.0	Pickles, sour	3.0–3.4
Butter	6.1–6.4	Pimento	4.6–5.2
Cabbage	5.2–5.4	Plums	2.8–3.0
Carrots	4.9–5.3	Potatoes	5.6–6.0
Cheese	4.8–6.4	Pumpkin	4.8–5.2
Cherries	3.2–4.0	Raspberries	3.2–3.6
Cider	2.9–3.3	Rhubarb	3.1–3.2
Corn	6.0–6.5	Salmon	6.1–6.3
Crackers	6.5–8.5	Sauerkraut	3.4–3.6
Dates	6.2–6.4	Shrimp	6.8–7.0
Eggs, fresh white	7.6–8.0	Soft Drinks	2.0–4.0
Flour, wheat	5.5–6.5	Spinach	5.1–5.7
Gooseberries	2.8–3.0	Squash	5.0–5.4
Grapefruit	3.0–3.3	Strawberries	3.0–3.5
Grapes	3.5–4.5	Sweet Potatoes	5.3–5.6
Hominy (Lye)	6.8–8.0	Tomatoes	4.0–4.4
Jams, fruit	3.5–4.0	Tuna	5.9–6.1
Jellies, fruit	2.8–3.4	Turnips	5.2–5.6
Lemons	2.2–2.4	Vinegar	2.4–3.4
Limes	1.8–2.0	Water, drinking	6.5–8.0
Maple Syrup	6.5–7.0	Wines	2.8–3.8

pH VALUES OF BIOLOGIC MATERIALS

Blood, plasma, human	7.3–7.5	Duodenal Contents, human	4.8–8.2
Spinal Fluid, human	7.3–7.5	Feces, human	4.6–8.4
Blood, whole, dog	6.9–7.2	Urine, human	4.8–8.4
Saliva, human	6.5–7.5	Milk, human	6.6–7.6
Gastric Contents, human	1.0–3.0	Bile, human	6.8–7.0

BUFFER SYSTEMS

The following table gives some common buffer systems and the approximate pH of maximum buffer capacity. The zone of effective buffer action will vary with concentration, but the general average will be ±1.0 pH from the value given, for concentrations approximately 0.1 molar.

Glycocoll-Sodium Chloride-Hydrochloric Acid	2.0
Potassium Acid Phthalate-Hydrochloric Acid	2.8
Primary Potassium Citrate	3.7
Acetic Acid-Sodium Acetate	4.6
Potassium Acid Phthalate-Sodium Hydroxide	5.0
Secondary Sodium Citrate	5.0
Carbonic Acid-Bicarbonate	6.5
Primary Phosphate-Secondary Phosphate	6.8
Primary Phosphate-Sodium Hydroxide	6.8
Boric Acid-Borax	8.5
Borax	9.2
Boric Acid-Sodium Hydroxide	9.2
Bicarbonate-Carbonate	10.2
Secondary Phosphate-Sodium Hydroxide	11.5

APPROXIMATE pH VALUES OF VARIOUS ACIDS AND BASES

ACIDS	pH VALUE	BASES	pH VALUE
Hydrochloric Acid	1.0	Sodium Bicarbonate	8.4
Sulfuric Acid	1.2	Borax	9.2
Phosphoric Acid	1.5	Ammonia	11.1
Acetic Acid	2.9	Sodium Carbonate	11.6
Alum	3.2	Trisodium Phosphate	12.0
Carbonic Acid	3.8	Sodium Metasilicate	12.2
Boric Acid	5.2	Sodium Hydroxide	13.0

Courtesy of W. A. Taylor & Co., Baltimore, Maryland

APPLICATION OF pH CONTROL

BREAD

pH value around 5.0 gives best results as to loaf volume, texture, etc. Different types of bread have their own optimum pH. Maximum diastatic activity occurs at pH of about 4.5–5.0.

CRACKERS

Crackers with too great an excess of soda not only are brown and appear burned but have too large a volume for standard containers. Acid crackers tend to be white, lacking in crispness, and are often too heavy for containers. If the dough has a pH of 7.1 after adding bicarbonate, satisfactory crackers result. Baking increases the pH. In some cases it may be desirable to make acid crackers and the pH of dough can be modified accordingly.

CANNING

In canning foods, time and temperature required to sterilize depends considerably on the pH of the food. At relatively low pH (common fruits, under 4.0) a light process is usually sufficient. A heavier process is necessary for most common vegetables (carrots, beets, beans, etc., 5.0–6.0). Foods having pH over 6.0 (corn, peas, fish, meat) require very heavy processing. Variations in the pH of any lot due to different treatment, etc., may necessitate a modification in processing. The taste of food is usually influenced by pH, notably in the case of tomatoes. (Bull. 17-L, National Canners Association.)

GELATIN AND GLUE

The chemical properties of gelatin and glue, such as melting point, viscosity, water absorption, solubility, jelly strength, etc., are all influenced by the pH of their solutions. The degradation products of gelatin when dissolved for use depends upon the pH. Between pH 4.7 and 7.7 there is very little swelling. Maximum swelling occurs at pH 2.4. Glue for sealing cartons should have a pH around 7.0.

JELLY

In making fruit jellies, jelly formation may be controlled by adjusting the pH of the fruit juice. Above about pH 3.6 jelly formation does not occur. As the pH drops to 3.0 jelly strength increases. Below 3.0 sweating tends to occur.

FERMENTATION

In the fermentation of molasses to ethyl alcohol, mashes are adjusted to between pH 5.0 and 6.0, average about 5.5.

ANALYSES AND TESTS

ANALYSES AND TESTS FOR FRESH EGGS, DRIED EGGS, EGG ALBUMEN AND EGG YOLK

CANDLING EGGS

A very convenient form of candling device can be made by any tinsmith. The device should have the form of a cylinder-shaped chimney similar to the glass chimneys used on lamps. A small opening should be made about one-half to three-fourths of the way on the side of the cylinder, to which should be soldered a cone-shaped piece of tin having another opening on the bottom. The opening should be just large enough to allow the egg to pass through, put lengthwise. By placing this apparatus over the top of a small oil lamp, it is possible to pass the egg through the opening on the side of the cone-shaped chamber and observe it through the light. If candling is carried on in a dark room, the baker can with very little practice determine quite accurately the condition of the egg.

In order to become thoroughly familiar with candling eggs, it is advisable to select a series of from 8 to 10 eggs, ranging from an egg 1 to 2 days old up to eggs 10 weeks old. By examining a series of this kind, it will be noticed that in the fresh egg the yolk will be very much intact and the air chamber on the upper portion of the egg will be very small. As progression is made in the series, it will be observed that the yolk is less intact and that the air chamber gradually increases in size. After having examined a series of this kind it will be possible with very little practice to approximately determine the age of the eggs under examination.

EXAMINING THE EGGS ON A PORTION OF THE PLATE

After the series of eggs have been examined by candling it is advisable to break each egg carefully onto a plate and arrange them in order. By carefully observing the eggs on a portion of the plate it will be found that there will be a difference in the symmetry and the appearance of the yolk as well as the white. The yolk of the fresh egg will be as before, very much intact, while the white will have a firm formation. As progress is made in this examination, it will again be observed that the yolk gradually loses its firmness while the white becomes more watery. Very often in

making examinations of eggs it will be found that the egg will have blood streaks and little clots known as meat spots. Meat spots may be found in fresh eggs, while streaks are the result of incubation.

FRESH EGGS

GRADE SPECIFICATIONS

For Nearby Fancy Grade, Grade A and Grade B, ten or more eggs in each dozen must meet the standard for the grade as given below. Two eggs in each dozen may be below the standard specification, but may not be below the standard for the next lower grade. For Grade C and Unclassified Grade each lot of eggs offered for sale must meet the requirements as given.

Grade Factors	Nearby Fancy Grade	Grade A	Grade B	Grade C	Unclassified Grade
Size	Uniform	Uniform	Uniform	May be variable	May be variable
Shell	Clean, sound	Clean, sound	Clean, sound	May be clean or dirty, sound or cracked	May be clean or dirty, sound or cracked.
Air-Cell (Candling Test)	⅛″ or less in depth, localized, regular.	⅜″ or less in depth, localized, regular	⅜″ or less in depth, localized, may be slightly tremulous	May be over ⅜″ in depth, may be bubbly or freely mobile	No fixed standards for this grade. Eggs may be variable in quality, but none may be below the requirements for C
White (Candling)	Firm, clear	Firm, clear	Reasonably firm	May be weak and watery	As above
Germ (Candling)	No visible development	No visible development	Development may be slightly visible	Development but no blood	May be clearly visible showing no blood

FRESH EGGS

The term "fresh" may be applied, in addition to the proper grade designation, to any lot of eggs sold as a unit, which are free from objectionable odor and flavor and which meet the requirements for Nearby Fancy or Grade A (not below requirements of Grade A).

The specific gravity of fresh eggs is about 1.090. After 30 days it may be 1.035.

A simple method of determining the specific gravity and inferring the age consists in dissolving 2 ounces of salt in 1 pint of water and noting the depth to which the eggs sink in this solution.

An egg 1 day old will sink below the surface, but not to the bottom, while one 3 days old will swim just immersed in the liquid. If more than 3 days old, the egg will float on the surface, the amount of shell exposed increasing with age. If 2 weeks old, only a little of the shell will dip in the liquid.

ANOTHER METHOD TO DETERMINE THE AGE OF EGGS

Place the egg in a 10% solution of salt.

Perfectly fresh eggs sink to the bottom. Those remaining immersed, but suspended in the liquid, are at least 3 days old. Those rising to the surface and floating are more than 5 days old. The older the egg, the higher it floats and the more it will stand on end.

Not applicable to preserved eggs.

DETECTING COLD STORAGE EGGS

By dipping eggs in lamp black, one can tell immediately whether they are freshly laid or cold storage.

The test depends upon the fact that storage eggs are treated with an oil to preserve them. If it is a cold storage egg, the lamp black will cling readily to the outer shell, while the amount of lamp black adhering to a fresh egg is negligible.

DRIED EGGS

Moisture	4.61– 8.5 %
Protein	40.4 –49.7 %
Lecithin and Fat	31.7 –45.12%
Ash	3.42– 4.27%
	4.7 – 7.43%
	1.18– 1.37%

A moisture and ash determination is all the compounder can do in his laboratory. The results are best compared with a known sample of a good quality.

ALBUMEN OR EGG WHITE

Egg albumen is generally transparent and of a light yellow color.

On treatment with cold water commercial albumen of good quality should dissolve almost completely. In making the test, the albumen should always be added to the water and not vice versa.

Five grams of albumen added to 50 cubic centimeters of water and leaving no residue is considered a high-grade sample.

ALBUMEN WHIPPING TEST

This test is quickly made and shows whipping quality.

Place 6 ounces of water in the whipping bowl and add 1 ounce of albumen. Whip until stiff. (For comparison tests one should whip all samples a given time and then compare the volume obtained.) Leave the whipped albumen overnight in a funnel with long stem, close the stem with a cork. Note the amount of water that leaked out during the night.

Commercial albumen is frequently adulterated with dextrins, gums, sugar, flour, etc.

Add 5 grams slowly to 50 cubic centimeters of water until the soluble matter is dissolved. (Pure and high-grade samples leave no residue.)

Add a few drops of acetic acid and filter through silk or fine muslin into a 500-cubic centimeter flask.

The insoluble residue may consist of coagulated albumen, casein, starch, etc.

Treat the albumen with very dilute caustic soda solution, filter and then exactly neutralize the filtrate with acetic acid. If casein is present it will be dissolved by the caustic soda and precipitated on neutralization.

Make the original filtrate up to 500 cubic centimeters. Pour about 100 cubic centimeters into a beaker and heat to boiling. This should coagulate the albumen. Filter and treat the filtrate with a little acetic acid and potassium ferrocyanide solution to make sure that no proteins remain in the solution.

If there is a precipitate, filter it out (a precipitate generally indicates casein, although it must be remembered that any zinc would be thrown out as white ferrocyanide).

Cool the filtrate and add a little concentrated tannin solution. This will precipitate any gelatin or glue. Filter and concentrate the filtrate to a small bulk. Cool and treat with a considerable excess of alcohol. Any

TABLE

PER CENT OF EGG WHITE CORRESPONDING TO TOTAL SOLIDS IN COMMERCIAL EGG YOLKS

Analysis			Analysis		
Per cent Total Solids	Per Cent Moisture	Per Cent Egg White	Per cent Total Solids	Per Cent Moisture	Per Cent Egg White
49.7	50.3	0.0	44.8	55.2	13.1
49.6	50.4	0.2	44.7	55.3	13.3
49.5	50.5	0.5	44.6	55.4	13.8
49.4	50.6	0.9	44.5	55.5	13.9
49.3	50.7	1.1	44.4	55.6	14.1
49.2	50.8	1.2	44.3	55.7	14.3
49.1	50.9	1.3	44.2	55.8	14.7
49.0	51.0	1.9	44.1	55.9	14.9
48.9	51.1	2.1	44.0	56.0	15.1
48.8	51.2	2.2	43.9	56.1	15.3
48.7	51.3	2.5	43.8	56.2	15.9
48.6	51.4	2.9	43.7	56.3	16.0
48.5	51.5	3.1	43.6	56.4	16.2
48.4	51.6	3.3	43.5	56.5	16.6
48.3	51.7	3.8	43.4	56.6	16.9
48.2	51.8	4.1	43.3	56.7	17.1
48.1	51.9	4.2	43.2	56.8	17.3
48.0	52.0	4.4	43.1	56.9	17.8
47.9	52.1	4.8	43.0	57.0	17.9
47.8	52.2	5.0	42.9	57.1	18.1
47.7	52.3	5.2	42.8	57.2	18.3
47.6	52.4	5.3	42.7	57.3	18.7
47.5	52.5	5.9	42.6	57.4	18.9
47.4	52.6	6.1	42.5	57.5	19.1
47.3	52.7	6.3	42.4	57.6	19.3
47.2	52.8	6.5	42.3	57.7	19.9
47.1	52.9	7.0	42.2	57.8	20.1
47.0	53.0	7.1	42.1	57.9	20.3
46.9	53.1	7.3	42.0	58.0	20.5
46.8	53.2	7.7	41.9	58.1	20.8
46.7	53.3	7.9	41.8	58.2	21.0
46.6	53.4	8.1	41.7	58.3	21.3
46.5	53.5	8.3	41.6	58.4	21.7
46.4	53.6	8.9	41.5	58.5	21.9
46.3	53.7	9.1	41.4	58.6	22.1
46.2	53.8	9.2	41.3	58.7	22.3
46.1	53.9	9.5	41.2	58.8	22.9
46.0	54.0	9.9	41.1	58.9	23.0
45.9	54.1	10.1	41.0	59.0	23.2
45.8	54.2	10.2	40.9	59.1	23.5
45.7	54.3	10.8	40.8	59.2	23.9
45.6	54.4	10.9	40.7	59.3	24.0
45.5	54.5	11.1	40.6	59.4	24.2
45.4	54.6	11.3	40.5	59.5	24.5
45.3	54.7	11.8	40.4	59.6	24.9
45.2	54.8	12.0	40.3	59.7	25.1
45.1	54.9	12.3	40.2	59.8	25.3
45.0	55.0	12.5	40.1	59.9	25.8
44.9	55.1	12.8	40.0	60.0	25.9

precipitate indicates the presence of gums or dextrins. Filter, boil off all the alcohol, treat with diluted HCl and test the solution in the usual way with Fehling's solution, after neutralizing the excess hydrochloric acid (HCl). Any reduction indicates, but does not necessarily prove, the presence of sugar. Sugar may also be extracted by treating the original solid sample with alcohol.

SOLUBLE COAGULABLE ALBUMEN

Pipette 100 cubic centimeters of the original aqueous solution (equivalent to 1 gram) into a beaker. Add about 1 gram of sodium acetate and heat to boiling. Filter the flocculent precipitate on a tared filter, using a platinum cone or Gooch crucible and suction. Wash with hot water. Dry at 100° C. and weigh.

SPRAY EGG YOLK

To 1 ounce of yolk add enough water to obtain a moist paste. Then add 3 more ounces, a little at a time, stir, and let stand for 3 hours. No in-between layer should be formed.

TEST FOR IRON SALTS IN SUGAR

1. Place some sugar solution in a test tube, add a few drops of weak nitric acid and some solution of ferrocyanide of potassium. A greenish-blue coloration and precipitate indicates iron salts.
2. Place some sugar solution in a test tube, add a few drops of weak nitric acid and some solution of sulphocyanide of potassium. A pale pink to blood red coloration indicates iron salts.
3. Place some sugar solution in a test tube, add a few drops of tannic acid solution. A light-colored precipitate gradually darkening to black indicates iron salts.

SUGAR-BOILING TESTS

Use 1 quart of water to 6 pounds of sugar.

No. 1. COMMON TEST (210°–220° F.)

Dip skimmer into the boiling sugar. If the sugar falls quickly and in large drops it is ready.

No. 2. SMOOTH STAGE TEST (218°–220° F.)

Dip the tip of the forefinger into it. Press the finger and thumb together and pull quickly apart again. If it pulls to a thread which breaks readily, then the sugar is ready. The sugar has an oily feeling, therefore the name "Smooth Stage."

No. 3. LARGE THREAD TEST (227°–230° F.)

Proceed as under No. 2. The thread must not break and should be pulled so any time.

No. 4. SMALL BLOW TEST (230°–236° F.)

Dip skimmer into boiling sugar, let it drip slightly and then blow through the holes. If on the other side of the skimmer small bubbles appear, the sugar is ready.

No. 5. BLOW TEST (238°–240° F.)

Proceed as under No. 4, but when blowing through the skimmer, the bubbles must fly like soap bubbles.

No. 6. SOFT BALL TEST (242°–245° F.)

Dip your forefinger in ice water, then quickly in the boiling sugar and again in the ice water. If the sugar on finger can be rounded in a soft ball, the test is correct.

No. 7. LARGE BALL TEST (250°–255° F.)

Proceed as under No. 6, and when a large, round ball is obtained the sugar is ready.

No. 8. SMALL CRACK TEST (265°–270° F.)

Proceed as under No. 6. If the sugar breaks while in the water, but clings to the teeth if chewed, the degree is reached.

No. 9. HARD CRACK TEST (280°–310° F.)

Proceed as under No. 6. If the sugar cracks loudly and chews fine, without sticking to the teeth, it is ready.

No. 10. CARAMEL TEST (320°–350° F.)

When the sugar turns yellow and then a nice golden brown, the caramel state is reached. Do not burn the sugar, but make it as dark as wanted.

For use as coloring, add an equal amount of water to the sugar, boil up, and allow to cool. Bottle for use as coloring and flavoring.

Note: When boiling sugar, remove scum and other unclean matter which rises to the top and settles on the sides of the kettle with a skimmer. Wash down the sides of the kettle with a wet sponge to prevent the sugar from graining.

OTHER SUGAR-COOKING TESTS

Thread or Pearl	**220° F. (104° C.)**
Soft Ball	**240° F. (116° C.)**
Hard Ball	**250° F. (121° C.)**

Soft Crack	260° F. (127° C.)
Hard Crack	290° F. (143° C.)

COMMERCIAL GLUCOSE (Allen's Test)

Dextrine is present in commercial glucose, but not in pure honey.

Dilute half the honey with water and add methyl alcohol (CH_3OH) in excess, constantly stirring, until there is a permanent turbidity. If glucose is present a heavy, gummy precipitate will soon form. Genuine honey gives only a slight milkiness.

ANOTHER TEST FOR COMMERCIAL GLUCOSE

Dilute the honey with an equal volume of water, then add a few cubic centimeters of iodine solution (iodine, 1 gram; potassium iodide, 3 grams; water, 50 cubic centimeters).

In the presence of commercial glucose the solution turns red or violet.

INVERT SUGAR (Added Commercial Invert Sugar)

Dissolve 1 gram of resorcin in 100 cubic centimetrs of concentrated hydrochloric acid. Introduce 10 cubic centimeters of a 50% honey solution into a test tube and add 5 cubic centimeters of ether. Shake gently and let stand for some time until the ether layer is clear.

Transfer 2 cubic centimeters of this clear ether solution to a small test tube and add a large drop of the fresh resorcin solution. Shake and note the color immediately. In the presence of commercial invert sugar the resorcin immediately assumes a cherry red color. Yellow to salmon shades have no significance.

ANALYSIS OF COFFEE

COUNTING TEST ON UNROASTED COFFEE BEANS

Bean	No. of Seeds in 50-cc. Measure
Fine Brown Java	187
Fine Mysore	198
Fine Neilgherry	203
Costa Rica	203
Good Ordinary Guatemala	207
Good Laguayra	210
Good Average Santos	213
Fine Long Berry Mocha	217
Good Ordinary Java	223
Fine Ceylon Plantation	225

Bean	No. of Seeds in 50-cc. Measure
Good Average Rio	236
Medium Plantation Ceylon	238
Manila	248
Ordinary Mocha	270
West African	313

TEST FOR PURITY

GROUND COFFEE

ALBERT SMITH'S TEST

Boil 10 grams of the sample in 250 cubic centimeters of water. Strain. Add basic lead acetate solution in slight excess. A precipitate forms, and when it has settled, the supernatant liquid will be colorless if the coffee is pure, but more or less colored if chicory is present.

ANALYSIS OF TEA

TOTAL ASH

Five grams of the sample are placed in a platinum dish and ignited over a Bunsen burner until complete incineration is accomplished. The dish is allowed to cool in a desiccator, and is then quickly weighed.

In genuine tea, the total ash should not be much below 5%, nor much above 6%, and it should not be magnetic.

In "faced teas," the proportion of total ash is sometimes 10%.

In "lie-tea," it may reach 30%.

In "spent-tea," it frequently falls below 3%, the ash being very rich in lime salts.

ASH INSOLUBLE IN WATER

The total ash obtained is washed in a beaker, and boiled with water for a considerable time. It is then brought upon a filter, washed, dried, ignited, and weighed.

In unadulterated tea, it rarely exceeds 3% of the sample taken.

ASH SOLUBLE IN WATER

This proportion is obtained by deducting the ash insoluble in water from the total ash.

Genuine tea contains from 3–3½% of soluble ash, or at least 50% of the total ash, whereas in exhausted tea the amount is often but 0.5%. The

following formula can be used for the calculation of the per cent of spent tea:

$$E = (6 - 2S)\ 20$$
$$E = \text{Spent tea}$$
$$S = \text{Per cent of soluble ash}$$

ANALYSIS AND TESTS FOR FLOUR

MOISTURE

Weigh about 2 grams of the sample on a weighing dish and dry for 5 hours in a drying oven at 100° C. (212° F.). Put in desiccator and weigh. Replace in the oven and heat to constant weight.

ASH

Weigh accurately into a weighed porcelain crucible about 5 grams of the sample. Burn over a Bunsen flame at a dull red heat, taking care not to fuse the ash. Weigh.

ABSORPTION

Weigh 25 grams of flour into a round bottom dish, add water from a burette, at first about 10–12 cubic centimeters. Stir the flour until a smooth dough ball has been formed. Then add slowly more water, drop by drop. Knead the dough ball between the fingers. Water is added until no more dough adheres to the hand. When this point is reached, the highest point of absorption is reached. Calculate.

A 60% absorption is called fair.

GLUTEN

Ten grams of the sample are mixed with sufficient water to make a stiff dough and allowed to stand for 1 hour. The mass is kneaded in a piece of linen in running water until the washings are clear. The fresh gluten thus obtained should have a faint yellow tinge, be tough and of such a consistency that it can be pulled out into threads. Gray and red glutens indicate inferior samples. Good wheat flour will yield from 7–18%.

GLUTEN OBTAINED FROM A MIXTURE OF

Wheat and rye flours is dark and viscous, no homogeneity.

Wheat and barley flours is dark, non-viscous, dirty reddish-brown.

Wheat and oat flours is dark yellow.

Wheat and maize flours is yellowish, not elastic.

Wheat and leguminous flours is from grayish red to green.

COLOR

The sample may be compared with one of known quality by laying out heaps of equal size, say 3 centimeters by 8 centimeters and 0.5 centimeter deep. If this is done on a colorless glass plate, the examination may be made with both white and colored background and the plate may subsequently be immersed in water (not over 35°) so that the colors produced on wetting may also be observed.

TEST TO DETECT BLEACHED FLOUR

Shake ½ ounce of flour with 2 ounces of gasoline or petrol ether. Let settle. Unbleached flour will impart to the fluid a yellow color. Bleached flour leaves the gasoline quite white.

SUBSTITUTED FLOURS (Vogel's Method)

Mix

Alcohol (70%)	95 parts
Hydrochloric Acid	5 parts

Shake flour with this reagent in a test tube. Heat to boiling. Allow to settle.

FLUID

Colorless	Pure
Straw colored tint	Presence of gruffs with bran
Orange yellow	Presence of corn cockle flour
Flesh color	Presence of ergot
Green	Presence of buckwheat flour

The presence of starch is detected by adding iodine solution to the boiling water solution of the flour.

Blue to black coloration, according to the amount of starch, results.

ANALYSIS OF STARCH

TEST FOR STARCH

Any solution containing starch is turned blue by adding iodine test solution.

MOISTURE

For ordinary purposes it is sufficient to obtain an exact determination of the moisture present in the starch (see baking powder).

Air-dried starch contains from 13–18% water.

Kiln-dried starch contains no water.

Kiln-dried starch absorbs readily from 7–10% moisture from the air.

DETERMINATION OF STARCH (ACID CONVERSION METHOD)

Three grams of the substance are treated with about 50 cubic centimeters of cold water for an hour, with frequent stirring. The residue is collected on a filter and washed with sufficient water to make a total of 250 cubic centimeters. This liquid contains the soluble carbohydrates. The undissolved residue is heated for 2½ hours with 2.5% hydrochloric acid (200 cubic centimeters of water and 20 cubic centimeter of HCl, specific gravity 1.125) in a flask provided with a reflux condenser, cooled, neutralized with caustic soda solution, made up to 250 cubic centimeters, filtered, and the dextrose determined in 50 cubic centimeters of the filtrate. Add 30 cubic centimeters of each of the Fehling solutions and determine the dextrose according to the method given under sugar analysis.

The weight of dextrose obtained, multiplied by 0.90, gives the weight of starch.

ANALYSIS OF LEMON AND VANILLA EXTRACT

LEMON EXTRACT

Five per cent lemon oil (as required for lemon extract) requires 80% alcohol. Fifty cubic centimeters of water in a test tube, add 2 cubic centimeters of extract. If lemon oil is present, water will be milky.

VANILLA EXTRACT (Lead Number)

A pure vanilla extract should yield with normal lead acetate solution a heavy precipitate and should settle after a few minutes, leaving a clear, supernatant, partially decolorized liquid. Mere cloudiness may be due to caramel. No precipitate indicates artificial vanilla flavor.

TEST FOR COUMARIN

When potassium iodide solution is added in excess to an aqueous solution of coumarin it forms a precipitate, at first brown and flocculent, afterwards on shaking clotting together to form a dark green, curdy mass, leaving the liquid perfectly clear.

TEST FOR CARAMEL

Dilute 10 cubic centimeters of the substance to be tested with 2 cubic centimeters of distilled water, transfer to a test tube, and shake gently for 2 minutes with 16 cubic centimeters of a mixture of:

100 cc. Amyl Alcohol		
3 cc. Phosphoric Acid	}	Marsh Reagent
3 cc. Distilled Water		

Allow the layers to separate completely. The lower aqueous layer is colorless or very nearly so, if no caramel is used. Caramel is almost insoluble in acid amyl alcohol.

The strength of an extract is denoted by the manufacturer as 1-ounce, 1½-ounce, 2-ounce goods, according to the amount required to flavor 1 gallon of simple syrup of 30° to 34° Baumé.

For testing out small quantities of syrup, accurate results are obtained by:

One ounce of extract (or 480 drops) to 1 gallon of syrup, which is equivalent to:

¼ oz.	(or 120	drops)	to 1 qt.	syrup
1 dr.	(or 60	drops)	to 1 pt.	syrup
½ dr.	(or 30	drops)	to 8 oz.	syrup
¼ dr.	(or 15	drops)	to 4 oz.	syrup
⅛ dr.	(or 7½	drops)	to 2 oz.	syrup

ANALYSIS OF GUMS

ANALYSIS OF GUM TRAGACANTH

Tragacanth yields a practically colorless solution when boiled with aqueous phosphoric acid. Indian gum, on the other hand, gives a pink or rose solution.

TEST FOR STARCH

Prepare a mucilage by mixing 1 gram of tragacanth with 50 cubic centimeters of water. Dilute with more water and filter. The residue is colored black-blue on the addition of iodine test solution, but not so the filtrate. If the latter shows a blue color on adding the iodine test solution, starch is present as an adulterant.

TEST FOR GUM ARABIC

To the mucilage of 1 part tragacanth and of 50 parts water add 2 grams of freshly prepared guaiac tincture (1 gram guaiac resin in 50 cubic centimeters of alcohol). No blue coloration of the liquid results after 3 hours, otherwise the tragacanth is adulterated with gum arabic.

TEST FOR INDIAN GUM

Moisten 2 grams of tragacanth in a 100-cubic centimeter beaker with a little alcohol. Add 50 cubic centimeters of distilled water, cover the

beaker with the hand, and shake well. Now add 50 cubic centimeters of 4% borax solution and let stand overnight. The mucilage formed must be of such consistency to be poured out of the beaker without drawing threads. If sticky, Indian gum is present.

ANALYSIS OF BALSAMS

PERU BALSAM

On account of the high price it demands in commerce, Peru balsam is often adulterated with Canada or Copaiba balsam, castor oil, alcoholic solutions of styrax, and other resins. To test balsam of Peru for adulterations, shake an equal volume of the balsam and benzine in a graduated test tube. If pure, the volume of the benzine is not increased and the color of the benzine not discolored.

ANALYSIS OF COUMARIN AND VANILLIN

TO TEST VANILLIN FOR ADULTERATIONS

1. Take melting point. Good vanillin does not melt below 80°–81° C.
2. No residue should be left on burning on platinum foil.
3. Boil 0.2 gram vanillin with 2 cubic centimeters of concentrated HCl and add 4 cubic centimeters of phenol solution and add filtered bleaching powder solution. A dirty violet tint should not appear. Add excess of ammonia. The violet color, if present, should not become blue. (Acetanilide.)

20 grams of Vanillin = 1 kilogram of Vanilla Beans

TO TEST COUMARIN FOR ADULTERATIONS

1. Take melting point. Should melt at 67° C.
2. One-tenth gram of coumarin is boiled with 1 cubic centimeter of HCl for a minute. The clear solution is treated with 2 cubic centimeters of phenol solution and a little chloride of lime (bleaching powder). The solution should not give a red coloration. A red color, turning to an indigo blue when excess of ammonia is added, indicates the presence of acetanilide.

1 gram of Coumarin = 60 grams of Tonka Beans
(60 grams = 2.12 ounces)

ANALYSIS OF CANNED FRUIT

In the case of canned fruits, an examination of the syrup in which the fruits are preserved is often sufficient.

METHOD OF DETERMINING DRAINED WEIGHT

To determine drained weight, the contents of No. 2½ cans or smaller cans should be emptied on a circular ⅛-inch mesh screen, 8 inches in diameter, set in a frame with a vertical side higher than the level of the product on the screen. The contents of can should be distributed over the screen so as to form a layer of uniform depth, this being accomplished, so far as possible, by the manner of emptying from the can. When necessary, fruit in halves is turned over with the pit side down to permit draining of any liquid present in the pit cavity, but this should be done in such a way as to express no additional amount of liquor from the material. The period of draining should be 2 minutes. The method of determining drained weight of No. 10 cans should be the same as the foregoing, with the exception that a circular ⅛-inch mesh screen, 12 inches in diameter, be used. This screen also should be set in a frame with a vertical side higher than the level of the product on the screen.

See table for ingoing and outgoing syrup.

Use a Brix or Baumé hydrometer for sugar determination.

A Brix hydrometer gives the per cent of sugar direct. For Baumé use table.

TESTING POWDERED MILK

TASTE TEST

Dissolve 2¼ ounces of powdered whole milk of 1½ ounces of powdered skim milk in a pint of cold water. Place the powder on top of the water and stir until dissolved, using an egg beater. Let stand 15 minutes and taste the milk. Good milk powders will have a fresh, natural taste; others may have a foreign or sour taste.

THE GLASS TEST

Let the glasses of milk stand overnight in a cool place. Next morning examine the milk through the bottom of the glass for sediment or black specks. Pour the milk slowly out of each glass into another one. Look carefully for sediment and specks as you get near the bottom of the glass. Let the glasses of milk stand in a warm place until they sour naturally and curdle. Powder made from clean milk will have a clean sourness, not unpleasant, while that made from milk which has not been so carefully handled will develop gas and off-flavors. Powder from clean milk will yield a solid, firm curd and a clear whey. Other milk will yield a curd full of gas bubbles and a dark-colored whey.

APPENDIX

Weights and Measures, Chemical Glossary, Bibliography, Abbreviations

WEIGHTS AND MEASURES

COMMON KITCHEN MEASURES

Equivalents of Capacity
(All measures level full)

3	teaspoons	= 1 tablespoon
½	fluid ounce	= 1 tablespoon
16	tablespoons	= 1 cup
2	gills	= 1 cup
½	liquid pint	= 1 cup
8	fluid ounces	= 1 cup
1	liquid pint	= 2 cups
16	fluid ounces	= 2 cups

DRY MEASURE

(For fruits, vegetables, and other dry commodities)

2	pints	= 1 quart
8	quarts	= 1 peck
4	pecks	= 1 bushel

(2150.42 cubic inches)

105	quarts	= 1 barrel

(7056 cubic inches)

LIQUID MEASURE

4	fluid ounces	= 1 gill
4	gills	= 1 pint
2	pints	= 1 quart
4	quarts	= 1 gallon

(231 cubic inches)

31½	gallons	= 1 barrel
2	barrels	= 1 hogshead

LINEAR MEASURE

12	inches	= 1 foot
3	feet	= 1 yard
5½	yards	= 1 rod
40	rods	= 1 furlong
8	furlongs	= 1 mile
1760	yards	= 1 mile
5280	feet	= 1 mile

CUBIC MEASURE

1728	cubic inches	= 1 cubic foot
27	cubic feet	= 1 cubic yard
144	cubic inches	= 1 board foot
128	cubic feet	= 1 cord *

* The use in trade of the so-called "face cord," which is less than the above, is illegal.

SQUARE MEASURE

144	square inches	= 1 square foot
9	square feet	= 1 square yard
30¼	square yards	= 1 square rod
160	square rods	= 1 acre
640	acres	= 1 square mile
36	square miles	= 1 township

AVOIRDUPOIS WEIGHT

27 11/32	grains	= 1 dram
16	drams	= 1 ounce
16	ounces	= 1 pound
4	quarters	= 1 hundredweight
20	hundredweights	= 1 ton

25	pounds	= 1 short quarter
28	pounds	= 1 long quarter
100	pounds	= 1 short hundredweight
112	pounds	= 1 long hundredweight
2000	pounds	= 1 short ton
2240	pounds	= 1 long ton

COMMON RULES OF MEASUREMENT

Rectangle Area = length × width

Solid with rectangular sides Volume = length × width × height

Circle { Circumference = 3.1416 × diameter
Area = 0.7854 × diameter × diameter

Cylinder { Area (exclusive of that of ends) = 3.1416 × diameter × height
Volume = 0.7854 × diameter × diameter × height

INTERNATIONAL METRIC SYSTEM

In the international metric system the fundamental unit is the meter—the unit of length. From this the units of capacity (liter) and of weight (gram) are derived. All other units are the decimal subdivisions or multiples of these. These three units are simply related; e.g., for all practical purposes 1 cubic decimeter equals 1 liter and 1 liter of water weighs 1 kilogram. The metric tables are formed by combining the words "meter," "gram," and "liter" with the six numerical prefixes, as in the following tables:

One meter = 39.37 inches; 1 liter = 1.0567 liquid quarts; 1 gram = 0.035 avoirdupois ounce.

UNITS OF LENGTH

Millimeter	=	0.001	meter
Centimeter	=	.01	meter
Decimeter	=	.1	meter
METER	=	1	meter
Decameter	=	10	meter
Hectometer	=	100	meters
Kilometer	=	1000	meters

UNITS OF CAPACITY

Milliliter	=	0.001	liter
Centiliter	=	.01	liter
Deciliter	=	.1	liter
LITER	=	1	liter
Decaliter	=	10	liters
Hectoliter	=	100	liters
Kiloliter	=	1000	liters

UNITS OF WEIGHT (OR MASS)

Milligram	=	0.001	gram
Centigram	=	.01	gram
Decigram	=	.1	gram
GRAM	=	1	gram
Decagram	=	10	grams
Hectogram	=	100	grams
Kilogram	=	1000	grams

UNITS OF AREA

The table of areas is formed by squaring the length measures, as in our common system. For land measure 10 meters square is called an "ARE" (meaning "area"). The side of 1 are is about 33 feet. The hectare is 100 meters square, and, as its name indicates, is 100 ares, or about 2½ acres.

APPROXIMATE WEIGHTS OF SOME COMMON DRY COMMODITIES

	Pounds per Bushel
Apples	48
Beans	60
Beets	60
Carrots	50
Cranberries	32
Cucumbers	48
Onions	57
Parsnips	50
Peaches	48
Peanuts	22
Pears	58
Peas (Dried)	60
Peas (Green, Unshelled)	56
Potatoes (White)	60
Potatoes (Sweet)	54
Tomatoes	56
Turnips	55

Ice: 1 cubic foot	=	57.2	lb.
30 cubic inches	=	1	lb.
Sugar, granulated: 1 cup	=	½	lb.
Butter: 1 cup	=	½	lb.
Lard: 1 cup	=	½	lb.
Flour: 1 cup	=	¼	lb.
Rice: 1 cup	=	½	lb.
Cornmeal: 1 cup	=	5	oz.
Raisins (stemmed): 1 cup	=	6	oz.
Currants (cleaned): 1 cup	=	6	oz.
Bread crumbs (stale): 1 cup	=	2	oz.
Chopped meat (packed): 1 cup	=	½	lb.

These weights are approximate only and should therefore not be used to determine whether correct measure is given or received.

APPROXIMATE WEIGHTS OF SOME COMMON MATERIALS

	Pounds per Cubic Foot
Coal	
Bituminous (piled loose)	44 to 54
Anthracite (piled loose)	50 to 57
Coke (piled loose)	23 to 32
Charcoal of pine and oak	15 to 30
Earth (common loam)	
Dry (loose)	72 to 80
Moist (moderately packed)	90 to 100
Soft mud (packed)	110 to 120
Masonry	
Brickwork	100 to 140
Roughly scabbled mortar rubble	140 to 150
Mortar (hardened)	103
Sand	90 to 117
Gravel	90 to 117
Trap (quarried, in loose piles)	107

	Pounds per 1000 Board Feet	Pounds per Cubic Foot
Woods		
Fir (Balsam)	2170	26
Hemlock	2330 to 2580	28 to 31
Maple	3250 to 3920	39 to 47
Oak	3080 to 4670	37 to 56
Pine (American White)	1830 to 2580	22 to 31
Pine (Yellow)	1920 to 3080	23 to 37
Poplar	1830 to 2580	22 to 31

The wood is supposed to be seasoned and of average dryness.

USEFUL CONVERSION FACTORS OF U. S. MEASURES

To Convert From	*To*	*Multiply By*
Barrels (dry)	Bushels	3.281
	Pecks	13.12
	Pints	210
	Quarts	105.0
(liquid)	Gallons	31.5
	Pints (liquid)	252.0
	Quarts (liquid)	126.0

To Convert From	*To*	*Multiply By*
B. T. U.	Calories (gram)	252
Bushels	Barrels	0.3048
	Liters	35.24
	Pecks	4
	Pints	64
	Quarts	32
Calories (gram)	B. T. U.	0.00397
Cubic Centimeters	Drams (fluid)	0.2705
	Minims	16.23
	Ounces (fluid)	0.03381
	Pints (dry)	0.001816
	(liquid)	0.002113
Grains/Pound	Parts/Million	142.9
	Milligram/Kilogram	142.9
	Per cent	0.01429
Grams	Drams (Avoir.)	0.5644
	Grains	15.43
	Ounces (Avoir.)	0.03527
	Pounds (Avoir.)	0.002205
Grams/Liter	Grains/Gallon	58.42
	Parts/Million	1,000
	Per cent (Weight/Volume)	0.1
Liters	Bushels	0.02838
	Drams (fluid)	270.5
	Gallons	0.2642
	Gills	8.454
	Ounces (fluid)	33.81
	Pecks	0.1135
	Pints (dry)	1.816
	(liquid)	2.113
	Quarts (dry)	0.9081
	(liquid)	1.057
Minims (fluid)	Cubic Centimeters	0.06161
	Drams (fluid)	1/60
	Milliliters	0.06161
	Ounces (fluid)	1/480
Drams (Avoir.)	Grains	27.34
	Grams	1.772
	Ounces (Avoir.)	0.0625 or $\frac{1}{16}$
	Pounds (Avoir.)	1/256

To Convert From	*To*	*Multiply By*
Drams (fluid)	Milliliters	3.697
	Minims (fluid)	60
	Ounces (fluid)	0.125 or 1/8
	Pints (liquid)	0.007813
Gallons	Barrels (liquid)	0.03175
	Liters	3.785
	Ounces (fluid)	128
	Pints (liquid)	8
	Quarts (liquid)	4
Gills	Pints (liquid)	0.25 or 1/4
	Quarts (liquid)	0.125 or 1/8
Grains	Drams (Avoir.)	0.03657
	Grams	0.06480
	Ounces (Avoir.)	0.002286
	Pounds (Avoir.)	1/7000
Grains/Gallon	Parts/Million	17.12
	Milligram/Kilogram	17.12
	Per cent	0.00171
Ounces (Avoir.)	Drams (Avoir.)	16
	Grains	437.5
	Grams	28.35
	Pounds (Avoir.)	0.0625 or 1/16
(fluid)	Cubic Centimeter	29.57
	Drams (fluid)	8
	Gallons	1/128
	Gills	0.25 or 1/4
	Liters	0.02957
	Milliliters	29.57
	Minims	480
	Pints (liquid)	0.0625 or 1/16
Parts/Million	Per cent	0.0001
	Milligram/Kilogram	1.000
	Grains/Gallon	0.0584
	Grains/Pound	0.00700
Pecks	Bushels	0.25 or 1/4
	Liters	8.810
	Pints	16
	Quarts (dry)	8
Percentages	Grains/Gallon	584.2
	Grains/Pound	70

To Convert From	*To*	*Multiply By*
Percentages	Grams/Liter	10
	Milligrams/Kilograms	10,000
	Parts/Million	10,000
Pints (dry)	Bushels	0.01563 or 1/64
	Liters	0.5506
	Pecks	0.0625 or 1/16
	Quarts (dry)	0.5
(liquid)	Cubic Centimeters	473.2
	Drams (fluid)	128
	Gallons	0.125 or 1/8
	Gills	4
	Liters	0.4732
	Minims	7680
	Ounces (fluid)	16
	Quarts (fluid)	0.5 or 1/2
Pounds (Avoir.)	Drams (Avoir.)	256
	Grains	7,000
	Grams	453.6
	Ounces	16
Quarts (dry)	Bushels	0.03125
	Cubic Centimers	1,101
	Liters	1.101
	Pecks	0.125 or 1/8
	Pints	2
Quarts (liquid)	Cubic Centimers	946.4
	Drams (fluid)	256
	Gallons	0.25
	Liters	0.9463
	Ounces (fluid)	32
	Pints (liquid)	2
Tons, Long (Avoir.)	Kilograms	1,016
	Pounds (Avoir.)	2,240
Tons, Metric	Kilograms	1,000
	Pounds (Avoir.)	2,205
Tons, Short (Avoir.)	Kilograms	907.2
	Pounds (Avoir.)	2,000

$$T°C = 5/9\ (T°F - 32°)$$
$$T°F = (9/5\ C°) + 32°$$

Where T°C is temperature in degrees Centigrade
T°F is temperature in degrees Fahrenheit

AVOIRDUPOIS

Liquid Measures

Gallon	Quarts	Pints	Fluid Ounces	Fluid Drams	Minims	C. C. (Cubic Centi-metres	Cubic Inches	
1	4	8	128	1024	61440	3785.332	231	1 Gallon
	1	2	32	256	15360	946.333	57.75	1 Quart
		1	16	128	7680	473.167	28.875	1 Pint
			1	8	480	29.573	1.804	1 Ounce
				1	60	3.696	0.225	1 Drachm
					1	0.061	0.003	1 Minim
			0.033815			1.000	0.0491	1 Cubic centimetre
				0.27052		1.000		1 Cubic centimetre
					16.2311	1.000		1 Cubic centimetre

Dry Weights

Pounds (lb.)	Ounces ℥	Drachms ʒ	Grains (gr.)	Grams (g.)
1	16	256	7000	453.592
	1	16	437.5	28.349
		1	27.34	1.77184
			1	0.064798
	0.035274			1.000
		0.56438		1.000
			15.43235	1.000

APOTHECARY'S WEIGHT

(Apothecary's Grains and Avoirdupois Grains Are the Same)

Grains gr.	Scruples ℈	Drams ʒ	Ounces ℥	Pound lb.	Grams g.
20	1				1.29598
60	3	1			3.88794
480	24	8	1		31.10350
5760	288	96	12	1	
		0.25721			1
	0.77162				1
15.43235					1

APOTHECARY'S FLUID MEASURE

Minims	Drams	Ounces	Pints	Gallon
min.	fl. ʒ	fl. ℥		
60	1			
480	8	1		
7680	128	16	1	
		128	8	1

METRIC SYSTEM

WEIGHT

Milligrams	Centigrams	Decigrams	Grams	Kilogram
1.0	0.1	0.01	0.001	
10	1	0.1	0.01	
100	10	1	0.1	
1000	100	10	1	
			1000	1

LIQUID

1 cubic centimeter (cc.)	=	1 gram by weight	=	100 grams by weight
100 cubic centimeters	=	1 deciliter	=	1000 grams by weight
1000 cubic centimeters	=	1 liter	=	1 hectoliter
		100 liters		

METRIC CONVERSION TABLE

Centimeter	=	0.3937	inch
Meter	=	3.28	feet
Meter	=	1.09	yards
Kilometer	=	0.621	mile
Inch	=	2.54	centimeters
Foot	=	0.305	meter
Yard	=	0.914	meter
Mile	=	1.61	kilometers
Square centimeter	=	0.155	square inch
Square meter	=	10.764	square feet
Square meter	=	1.196	square yards
Square kilometer	=	0.386	square mile
Square inch	=	6.452	square centimeters
Square foot	=	0.0929	square meter
Square yard	=	0.836	square meter

METRIC CONVERSION TABLE—(*Continued*)

Square mile	=	2.59	square kilometers
Cubic centimeter	=	0.061	cubic inch
Cubic meter	=	35.29	cubic feet
Cubic meter	=	1.308	cubic yards
Cubic inch	=	16.4	cubic centimeters
Cubic foot	=	0.028	cubic meter
Cubic yard	=	0.765	cubic meter
Liter	=	0.0353	cubic foot
Liter	=	0.2642	U. S. gallon
Liter	=	61.023	cubic inches
Liter	=	2.202	pounds of water at 62° F.
Cubic foot	=	28.32	liters = 7.484 gallons
Gallon	=	3.785	liters
Cubic inch	=	0.0164	liter
Gram	=	15.432	grains
Gram	=	0.0353	ounce
Kilogram	=	2.205	pounds
Kilogram	=	0.0011	ton
Ton	=	2000	lb.
Grain	=	0.0648	gram
Ounce	=	28.35	grams
Pound	=	0.454	kilogram
Ton	=	907.03	kilograms
Ton	=	0.907	tonne

CONVERSION OF DEGREES CENTIGRADE INTO FAHRENHEIT AND VICE VERSA

$$\text{Degrees Centigrade} = 5/9\ (F - 32)$$
$$\text{Degrees Fahrenheit} = 9/5\ (C + 32)$$

N.B.: In case of negative temperatures (below zero) the words "add" and "subtract" are to be interchanged.

$$\text{Calorie} = 3.968\ \text{B.T.U.}$$
$$\text{B.T.U.} = 0.252\ \text{Calorie}$$

To convert degrees Baumé to specific gravity apply the formula:

$$\frac{144}{144 - \text{Bé. degree}} = \text{specific gravity. For liquids heaver than water}$$

and

$$\frac{144}{134 + \text{Bé. degree}} = \text{specific gravity. For liquids lighter than water}$$

COMMON WOODS

Commonly Used for Equipment and Structures in Food Plants

Data for this table from The Hauser-Stander Tank Co., Cincinnati, Ohio and Forest Products Laboratory, Forest Service, U. S. Department of Agriculture.

Kind of Wood	Weight per cu. ft. at 12 per cent moisture	Absorption of Food Ingredients* gm. per strip 4 in. x 1 in. x 1/4 in.							Per Cent Permanent Expansion, Caused by Food Ingredients						
		Water		Dilute Acetic Acid	Salt Brine		Cottonseed Oil		Water		Dilute Acetic Acid	Salt Brine		Cottonseed Oil	
		Cold	Hot	Cold	Cold	Hot	Cold	Hot	Cold	Hot	Cold	Cold	Hot	Cold	Hot
Cypress (Tidewater Red)	.32 lb.	3.8	5.4	4.3	1.6	5.7	2.1	4.4	1.0	2.0	3.5	2.5	1.0	0.0	—2.1
Douglas Fir	30 lb.	5.1	7.7	3.4	2.6	6.5	1.2	4.4	0.5	0.5	2.5	2.2	1.1	0.0	—2.4
Yellow Pine (Long Leaf)	41 lb.	4.9	5.8	2.9	1.9	5.8	1.6	2.2	2.5	3.0	2.8	1.5	1.0	0.0	—3.6
Redwood	30 lb.	5.9	6.4	4.5	5.1	7.9	3.6	5.2	3.5	13.0	7.0	5.5	1.1	0.0	—0.9
Hard Maple	44 lb.	8.2	7.9	6.1	5.8	8.3	1.1	4.4	1.5	0.5	4.4	3.5	1.1	0.0	—2.9
White Oak	48 lb.	6.5	8.3	4.4	2.2	4.8	0.7	1.1	1.0	0.0	1.5	1.0	1.1	0.0	—1.7

Kind of Wood	Weight per cu. ft. at 12 per cent moisture	Physical Effects of Food Ingredients **				Color Imparted to Food Ingredients					Taste Imparted to Water
		Water	Dilute Acetic Acid	Salt Brine 10 per cent	Cottonseed Oil	Water		Dilute Acetic Acid	Salt Brine 10 per cent	Cottonseed Oil	
						Cold	Hot	Cold	Cold	Hot	
Cypress (Tidewater Red)	32 lb.	None	None	None	None	No	Yes††	No	Yes	No	No
Douglas Fir	30 lb.	None	None	None	None	No	Yes††	No	No	No	Yes
Yellow Pine (Long Leaf)	41 lb.	None	None	None	None	No	Yes††	No	No	No	Yes
Redwood	30 lb.	None	SS†	SS†SB	SS†	Yes	Yes	Yes	Yes	Yes††	No
Hard Maple	44 lb.	None	None	None	None	No	Yes††	No	Yes	No	No
White Oak	48 lb.	None	None	None	None	Yes	Yes	Yes	Yes	Yes††	No

*Observed after 1 week with cold liquids and 8 hours with hot (boiling).
**Observations made after immersion for 1 month in the cold liquid.

†SS = slightly soft; SB = slightly brittle.
††Yields no color after a short period.

BAUMÉ AND SPECIFIC GRAVITY CONVERSION TABLE

For Heavy Liquids
American Standard:

$$\text{Sp. gr.} = \frac{145}{145 - {}^\circ\text{Bé.}} \text{ at } 60^\circ \text{ F.}$$

°Bé	Sp. gr.	°Bé	Sp. gr.
0	1.0000		
1	1.0069	36	1.3303
2	1.0140	37	1.3426
3	1.0211	38	1.3551
4	1.0284	39	1.3679
5	1.0357	40	1.3810
6	1.0432	41	1.3942
7	1.0507	42	1.4078
8	1.0584	43	1.4216
9	1.0662	44	1.4356
10	1.0741	45	1.4500
11	1.0821	46	1.4646
12	1.0902	47	1.4796
13	1.0985	48	1.4948
14	1.1069	49	1.5104
15	1.1154	50	1.5263
16	1.1240	51	1.5426
17	1.1328	52	1.5591
18	1.1417	53	1.5761
19	1.1508	54	1.5934
20	1.1600	55	1.6111
21	1.1694	56	1.6292
22	1.1789	57	1.6477
23	1.1885	58	1.6667
24	1.1983	59	1.6860
25	1.2083	60	1.7059
26	1.2185	61	1.7262
27	1.2288	62	1.7470
28	1.2393	63	1.7683
29	1.2500	64	1.7901
30	1.2609	65	1.8125
31	1.2719	66	1.8354
32	1.2832	67	1.8590
33	1.2946	68	1.8831
34	1.3063	69	1.9079
35	1.3182	70	1.9333

Used for sugar syrup and acids and liquids heavier than water.

For Light Liquids
American Standard:

$$\text{Sp. gr.} = \frac{140}{130 + {}^\circ\text{Bé.}} \text{ at } 60^\circ \text{ F.}$$

°Bé	Sp. gr.	°Bé	Sp. gr.
10	1.0000	51	.7735
12	.9859	52	.7692
15	.9655	53	.7650
18	.9459	54	.7609
20	.9333	55	.7568
21	.9272	56	.7527
22	.9211	57	.7487
23	.9150	58	.7447
24	.9091	59	.7407
25	.9032	60	.7368
26	.8974	61	.7330
27	.8917	62	.7292
28	.8861	63	.7254
29	.8805	64	.7216
30	.8750	65	.7179
31	.8696	66	.7143
32	.8642	67	.7107
33	.8589	68	.7071
34	.8537	69	.7035
35	.8485	70	.7000
36	.8434	71	.6965
37	.8383	72	.6931
38	.8333	73	.6897
39	.8284	74	.6863
40	.8235	75	.6829
41	.8187	76	.6796
42	.8140	77	.6763
43	.8092	78	.6731
44	.8046	79	.6699
45	.8000	80	.6667
46	.7955	81	.6635
47	.7910	82	.6604
48	.7865	83	.6573
49	.7821	84	.6542
50	.7778	85	.6512
		86	.6482
		87	.6452
		88	.6422
		89	.6393
		90	.6364

Used for ammonia, gasoline, and other liquids lighter than water.

BOILING POINT AND SPECIFIC GRAVITY OF VARIOUS LIQUIDS

	Boiling Point ° C.	Specific Gravity 20/4° C.	Approx. Lbs. Per U.S. Gal. Room Temp.
Acetic Acid, Glacial	118.1	1.049	8.74
Acetone	56.5	.792	6.60
Acetylene Tetrachloride	146.3	1.600	13.33
Alcohol, n-Amyl	137.9	.817 (20/20° C.)	6.81
Alcohol, Butyl	117	.810	6.75
Alcohol, Ethyl, 190 Proof	78.5	.815	6.79
Alcohol, Isopropyl	82.5	.789	6.55
Alcohol, Methyl 99.5%	64.7	.797 (15/15° C.)	6.64
Amyl Acetate (Banana Oil)	142	.876 (15/4° C.)	7.30
Aniline	184.4	1.022	8.51
Benzaldehyde	179	1.046	8.71
Benzene, C.P.	79.6	.879	7.32
Benzol, 90%	—	.876–.888	7.35
Carbon Disulfide	46.3	1.263	10.52
Carbon Tetrachloride	76.8	1.595	13.29
Castor Oil	—	.960–.967 (15/15° C.)	8.02
Chlorobenzene (mono)	132.1	1.107	9.22
Chloroform	61.2	1.489	12.40
Corn Oil	—	.921–.928 (15/15° C.)	7.71
Cyclohexanol (Hexalin)	160–1	.962	8.01
p-Cymene	176–7	.857	7.14
Diethylamine	55.5	.712 (15/15° C.)	5.93
Diethyl Phthalate	298–9	1.121 (25/25° C.)	9.34
Dimethylaniline	193	.956	7.96
Ethanolamine (mono)	171	1.022	8.51
Ether	34.6	.708 (25/4° C.)	5.90
Ethyl Acetate	77.1	.901	7.51
Ethylene Dichloride	83.7	1.257	10.47
Ethylene Glycol	197.4	1.113	0.27
Gasoline 60°	—	.740	6.16
Gasoline 70°	40–160	.700	5.83
Glycerol	290	1.260	10.50
Kerosene	150–300	.820	6.83
Linseed Oil	—	.934 (15/15° C.)	7.78
Nitrobenzene	210.9	1.205 (18/4° C.)	10.04
Paraffin Oil	—	.900	7.50
Pine Oil	150–185	.870	7.25
Piperidine	106	.860	7.16
Pyridine	115–6	.982	8.18
Solvent Naphtha	125–180	.861–.869	7.21
Sulfur Chloride (mono)	138	1.687	14.05
Toluene	110.8	.866	7.21
Triethanolamine	277–9 (150 mm.)	1.124 (20° C.)	9.36
Turpentine, Oil of	155–180	.873	7.27
Water	100	1.000 (4° C.)	8.33
Xylene Comm.	135–145	.860–.870	7.21
Mercury	356.9	13.546	112.84

PAPER

25 sheets	= 1 quire (qr.)
20 quires	= 1 ream (rm.)
2 reams	= 1 bundle (bdl.)
5 bundles	= 1 bale (bl.)

Some paper mills use 480 sheets to the ream instead of 500.

COMPARATIVE TIME OF EVAPORATION OF CERTAIN SOLVENTS

These figures give the relative rate of evaporation of 5 cubic centimeters of the solvent listed contained in a Petri dish 3½ inches in diameter, ⅜ inch in height (inside measurements).

1.	Carbon Bisulphide	4	minutes
2.	Acetone	4	"
3.	Chloroform	7	"
4.	70°–72° Gasoline	8	"
5.	Carbon Tetrachloride	9	"
6.	Pure Benzol	10	"
7.	Benzol, 100%*	11	"
8.	Benzol, 90%*	13	"
9.	Benzol, 50%*	22½	"
10.	Pure Toluol	29	"
11.	Commercial Toluol	31	"
12.	Solvent Naphtha	115	"
13.	"Motor" Gasoline	124	"
14.	Turpentine	200	"

* One hundred per cent benzol is a commercial benzol all of which distils over up to 100° C.; 90% benzol is one 90% of which distils over up to 100° C.; similarly, 50% of 50% benzol comes over up to 100° C. They are not pure benzene, but mixtures of benzene with toluene and higher homologues in varying proportions.

COMMON AND CHEMICAL NAMES OF VARIOUS MATERIALS

A

Acacia gum—gum arabic
Acetate of lime—calcium acetate
Acetic ether—ethyl acetate
Acetin—glyceryl monoacetate
Acetyl salicylic acid—aspirin
Acetylene tetrachloride—tetrachlorethane
Adeps lanae—lanolin
Alcohol—ethyl alcohol
Aldehyde—acetaldehyde
Alumina—aluminum oxide
Alum—potassium aluminum sulphate
Alundum—fused aluminum oxide
Ammonia aqua—ammonium hydroxide
Aniline oil—aniline
Animal charcoal—bone black
Aqua fortis—nitric acid
Aqua regia—nitric and hydrochloric acid
Argols—crude cream of tartar
Arsenic red—arsenic disulphide
Asphaltum—mineral pitch

B

Baking soda—sodium bicarbonate
Banana oil—amyl acetate
Barium white—barium sulphate
Baryta—barium oxide
Barytes—barium sulphate natural
Basafor—barium sulphate precipitated
Bauxite—aluminum oxide, hydrated
Benzene—benzol
Black boy gum—accroides gum
Black hypo—lead thiosulphate, impure
Blanc fixe—barium sulphate, precipitated
Bleaching powder—calcium hypochlorite
Blue lead, sublimed—basic lead sulphate
Blue stone }
Blue vitriol } —copper sulphate
Boiled oil—linseed oil, boiled
Bone black—animal charcoal
Boracic acid—boric acid
Borax—sodium tetraborate
Brazil wax—carnauba wax
Brimstone—sulphur
British gum—dextrin
Bromo "acid"—tetrabromfluorescin
Burnt sugar coloring—caramel color

Butanol—butyl alcohol
Butter color—annatto
Butter of antimony—antimony chloride
Butyric ether—ethyl butyrate

C

Cadmium yellow—cadmium sulphide
Calcium phosphate—calcium phosphate, monobasic
Calomel—mercurous chloride
Carborundum—silicon carbide
Capsicum—red pepper
Carbolic acid—phenol
Carragheen—Irish moss
Catechu—cutch
Caustic potash—potassium hydroxide
Caustic soda—sodium hydroxide
Ceresin wax—ozokerite and paraffin mixture
Chalk—calcium carbonate
China clay—aluminum silicate
China wood oil—tung oil
Chinese wax—insect wax
Chloride of lime—calcium hydrochlorite
Cholestrin—cholesterol
Chrome green—lead or zinc chromate or ferric ferrocyanide
Chrome yellow—lead chromate
Cinnabar—mercuric sulphide
Citronella oil—verbena oil
Cognac oil—oenanthic ether
Colloidal clay—bentonite
Collodion—nitrocellulose "solution"
Cologne spirits—ethyl alcohol (pure)
Colophony—rosin, pine resin
Columbian spirits—methyl alcohol
Colza oil—rape seed oil
Copper aceto arsenite—Paris green
Copper arsenite—Scheeles green
Corn sugar—dextrose, cerelose
Corn syrup—glucose, mixture of dextrin and dextrose and maltose
Corrosive sublimate—mercuric chloride
Corundum—aluminum oxide
Cream of tartar—potassium bitartrate
Cresol—cresylic acid
Crude oil—petroleum (crude)
Cyanamid—calcium cyanamide

D

Dead oil—creosote oil
Degras—wool grease
Dekalin—decahydronaphthaline
Dextrose—corn sugar, cerelose

Dope—pyroxylin "solution"
Dutch liquid—ethylene chloride

E

Earth, infusorial—diatomaceous earth
Earth wax—ozokerite, mineral wax
Egg oil—egg yolk
Elaterite—mineral rubber
Epsom salts—magnesium sulphate
Emery—impure aluminum oxide
Ester gum—glycerol ester of rosin
Ether—ethyl ether
Ethyl nitrite—nitrous ether

F

Fir, balsam—Canada balsam
Fixed white—barium sulphate
Flaxseed—linseed
Flea seed—psyllium
Fluorspar—calcium fluoride
Fool's gold—iron pyrite
Formalin—formaldehyde (40% solution)
French chalk, talc—magnesium silicate
Fuchsine—magenta
Fusel oil—amyl alcohol
Fuller's earth—aluminum silicate, hydrous

G

Galena—lead sulphide
Gasoline—petroleum spirit
Glance pitch—manjak
Glass, water—sodium silicate
Glauber salt—sodium sulphate ($10H_2O$)
Glycerine—glycerol
Glucose—corn syrup
Glycol—ethylene glycol
Graphite—plumbago
Green soap—soft soap
Green vitriol—ferrous sulphate
Grain alcohol—ethyl alcohol
Ground nut oil (Arachis oil)—peanut oil
Gum lac—shellac
Guncotton—nitrocellulose
Gypsum—calcium sulphate
Gugnets' green—chromium oxide, hydrated

H

Heavy spar—barium sulphate
Hematite—iron oxide
Hexalin—cyclohexanol

Hexamine—hexamethylenetetramine
Hydrosulphite—sodium hydrosulphite
Hypo—sodium thiosulphate

I

Ichthyol—ammonium sulfo ichthylate
Indene—para-cumarone
Indian gum—karaya, gum
Indian red—ferric oxide
Isinglass—pure fish gelatin
Italian red—iron oxide (red)
Ivory black—bone black

K

Kauri gum—copal, gum
Kaolin—aluminum silicate
Kieselguhr—diatomaceous earth

L

Lanolin—purified wool grease
Lanum—lanolin
Lead chromate—chrome yellow
Lead sulphide, basic—white lead, sublimed
Lemon, salts of—potassium binoxalate
Lemon yellow—barium chromate
Licorice—glycyrrhiza
Ligroin, light—petroleum ether
Lime, dry—calcium oxide
Lime, slaked—calcium hydroxide
Limestone—calcium carbonate
Litharge—lead monoxide
Liver of sulphur—potassium sulphide
Lithopone—zinc sulphide and barium sulphate
Lunar caustic—silver nitrate
Lye—sodium hydroxide
Lysol—cresol soap solution

M

Magnesia—magnesia oxide
Magnesite—magnesium carbonate, natural
Magnesium silicate—talc
Maize oil—corn oil
Malt sugar—maltose
Metol—methyl-para-aminophenol sulphate
Methanol—methyl alcohol
Microcosmic salt—sodium ammonium phosphate
Milk sugar—lactose
Mineral wax—ozokerite
Mineral pitch—asphalt

Minium—lead oxide (red)
Mirbane oil—nitrobenzol
Muriatic acid—hydrochloric acid
Myrtle wax—bayberry wax

N

Naphtha (petroleum)—petroleum distillate
Naphtha, solvent—coal tar naphtha
Naples yellow—lead antimonate
Nickel salts, double—nickel ammonium sulphate
Nickel salts, single—nickel sulphate
Niter—potassium nitrate

O

Oil of bitter almond—benzaldehyde (from bitter almond nut)
Oil of mirbane—nitrobenzol
Oil of mustard—allyl isothiocyanate
Oil of wintergreen—methyl salicylate
Oleic acid—red oil
Olein—glyceryl trioleate (natural)
Oleum—sulphuric acid (fuming)
Orange mineral—lead oxide (orange red)
Orpiment—arsenous sulphide (yellow)

P

Paraffin oil—mineral oil, petrolatum liquid
Paris white—calcium carbonate
Paris blue—ferric ferrocyanide
Pearl ash—potassium carbonate
Petrol—gasoline
Petrolatum—petroleum jelly
Plaster of Paris—calcium sulphate
Plumbago—graphite
Prussian blue—ferric ferrocyanide
Prussiate of potash, red—potassium ferricyanide
Prussiate of potash, yellow—potassium ferrocyanide
Prussic acid—hydrocyanic acid
Pyramidon—amidopyrine
Pyrethum—insect flowers (powdered)
Pyroligenous acid—wood vinegar (acetic acid)
Pyrolusite—manganese dioxide
Pyroxylin—nitrocellulose

Q

Quicklime—calcium oxide
Quicksilver—mercury
Quinol—hydroquinone

R

Red lead—lead tetroxide
Red oil—oleic acid
Red oxide—ferric oxide (red)
Rochelle salt—potassium sodium tartrate
Rosin—pine resin, colophony
Rottonstone—tripoli
Rouge—ferric oxide

S

Sal ammoniac—ammonium chloride
Satin white—reaction product of hydrated lime and alum
Salt—sodium chloride
Saltpeter—potassium nitrate
Salts of vitriol—zinc sulphide
Scale wax—paraffin wax (low melting point)
Silica—silicon dioxide
Slaked lime—calcium hydroxide
Sod oil—degras
Soda ash—sodium carbonate
Soda (washing)—sodium carbonate ($10H_2O$)
Sodium bisulphite—sodium acid sulphite
Sodium phosphate, dibasic—disodium phosphate
Soft soap—potash soap
Stearin—stearic acid
Sublimed lead—lead sulphate, basic
Sucrose—cane sugar, beet sugar
Sugar of lead—lead acetate
Sulphuric ether—ethyl ether

T

Talc—magnesium silicate
Tartar emetic—antimony potassium tartarate
Tetralin—tetrahydronaphthalene
Theobroma oil—cocoa butter
Titanium dioxide—titanium oxide
Toluol—toluene
Triacetin—glycerol triacetate
Tripoli—natural amorphorous silica not diatomaceous
Tripolite—diatomaceous earth
Train oil—whale oil
Trinitrophenol—picric acid
Turkey red oil—castor oil, sulphonated

V

Venetian red—ferric oxide
Vermilion—red mercuric sulphide
Verdigris—copper acetate, basic
Vitriol—sulphuric acid

W

Water glass—sodium silicate
White arsenic—arsenic trioxide
White bole—China clay, kaolin
White lead—lead carbonate, basic
White metal—Babbitt metal
White wax—beeswax bleached
Whiting—calcium carbonate
Witherite—barium carbonate, natural
Wintergreen oil, synthetic—methyl salicylate
Wood alcohol—methyl alcohol

X

Xylol—xylene

Y

Yacca gum—accroides gum

Z

Zinc white—zinc oxide
Zinc yellow—potassium zinc chromate

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ABBREVIATIONS

amp. .... ampere
avoir. .... avoirdupois
b.p. .... boiling point
Bé. .... Baumé
C. .... Centigrade
cc. .... cubic centimeter
c.d. .... current density
c.p. .... chemically pure
cu. in. .... cubic inch
cu. ft. .... cubic foot
d. .... density
dil. .... dilute
dr. .... dram
F. .... Fahrenheit
f.f.c. .... free from chlorine
f.f.p.a. .... free from prussic acid
fl. dr. .... fluid dram
fl. oz. .... fluid ounce
g. .... gram

ABBREVIATIONS—(*Continued*)

gal. . . . . gallon, gallons
gr. . . . . grain
hr. . . . . hour
kg. . . . . kilogram
l. . . . . liter
lb. . . . . pound, pounds
m.p. . . . . melting point
min. . . . . minute
min. . . . . minims
N. . . . . Normal
oz. . . . . ounce, ounces
pH . . . . hydrogen-ion concentration
pt. . . . . pint, pints
Q. S. . . . . A quantity sufficient to make
qt. . . . . quart, quarts
r.p.m. . . . . revolutions per minute
sec. . . . . second
Sp.G. . . . . specific gravity
Sq. dm. . . . . square decimeter
tsp. . . . . teaspoonful
U.S.P. . . . . U. S. Pharmacopeia
V. . . . . voltage
wt. . . . . weight

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